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# **SWATER**RESOURCES ABSTRACTS



VOLUME 6, NUMBER 23 DECEMBER 1, 1973 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior





VOLUME 6, NUMBER 23 DECEMBER 1, 1973

W73-14201 -- W73-14750

The Secretary of the U. S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

### FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

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Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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ABSTRACT SOURCES

## SELECTED WATER RESOURCES ABSTRACTS

### 01. NATURE OF WATER

### 1B. Aqueous Solutions and Suspensions

WATER IN BIOLOGICAL SYSTEMS, VOL 3. For primary bibliographic entry see Field 02K. W73-14650

### 02. WATER CYCLE

### 2A. General

PROBLEMS OF WATER RESOURCES USE AND CONSERVATION (PROBLEMY VOD-NYKH RESURSOV, IKH ISPOL'ZOVANIYA I OKHRANY), Institute of Geography of Siberia and the Far East,

Irkutsk. (USSR). For primary bibliographic entry see Field 06B. W73-14427

DECISIONS WITH INADEQUATE HYDROLOG-IC DATA.

Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado, D. A. Woolhiser, editor: Water Resources Publications, Fort Collins, 1973. 290 p.

Descriptors: \*Hydrologic data, \*Data collections, \*Decision making, Systems analysis, Cost-benefit analysis, Floods, Droughts, Reservoir design, Network design, Project planning, Water manage-

Identifiers: \*Inadequate hydrologic data.

There is a fundamental conflict of interest she tween the data gatherer and the water resource system designer and builder. The data expert wishes to improve the accuracy of his product which may require more years of observations with more accurate equipment. The designer and builder wish to get on with their work. In many circumstances the data are clearly inadequate. cumstances the data are clearly inadequate. If there are no budget constraints one should gather data until the marginal cost of the data is equal to the marginal benefits attributable to the data. As a practical matter this point is very difficult to find because of uncertainties in the benefits. Papers of this Symposium are classified in three major groups: (1) network design and regional studies, (2) rainfall and runoff simulation, and (3) reservoir system analysis. (See also W73-14551 thru W73-14570) (Knapp-USGS)

AN ECONOMIC APPROACH FOR EVALUATING THE ADEQUACY OF HYDROLOGIC

ING THE ADEQUACY OF HYDROLOGIC DATA,
Queen's Univ., Kingston (Ontario).
W. E. Watt, and K. C. Wilson.
In: Decisions with Inadequate Hydrologic Data;
Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 7-16, 1973. 1 fig, 5 ref.

Descriptors: \*Data collections, \*Network design, Descriptors: "Data collections, "Network design, "Economics, "Cost-benefit analysis, Project planning, Decision making, Gages, Instrumenta-tion, Hydrologic data, Water measurement, Stream gages, Rain gages, Precipitation gages. Identifiers: "Inadequate hydrologic data.

Hydrologic data can be considered adequate when the maginal cost associated with improving the data is just equal to the marginal benefit resulting from such an improvement. This concept can be applied to decisionmaking in planning regional hydrometric networks. In this case, the cost of improving the data accuracy is equal to the cost of in-creasing and operating the network. A logical ap-proach to the determination of marginal benefiterror of prediction is proposed. An expression is derived which relates the relative increase in cost of adopting a design different from the optimum to the error of prediction. This expression involves a capital cost exponent, a damage cost exponent, and a flood (or drought) frequency exponent; each exponent is defined by an average regional value. Application of this expression to the total future investment for a region yields the marginal benefit relation, which when combined with a marginal cost relation, can provide an objective basis for decisionmaking in the area of hydrometric net-work planning. (See also W73-14550) (Knapp-W73-14551

DESIGN OF HYDROMETRICAL NETWORKS AND APPLICATION TO COLOMBIA, World Meteorological Organization, Bogota

(Colombia).

(Colombia).

S. Stanescu, and W. Klohn.

In: Decisions with Inadequate Hydrologic Data;

Proceedings of 2nd International Symposium in

Hydrology, September 1972. Fort Collins,

Colorado: Water Resources Publications, Fort

Collins, p. 17-28. 1973. 2 fig., 17 ref.

Descriptors: \*Data collections, \*Network design, \*Economics, \*Cost-benefit analysis, Project \*Ecohomics, \*Cost-oenerit analysis, Florest planning, Decision making, Gages, Instrumenta-tion, Hydrologic data, Water measurement, Stream gages, Rain gages, Precipitation gages. Identifiers: \*Inadequate hydrologic data, \*Colom-

In 1968, Colombia began to organize a national hydrological service. One of the main tasks of this new activity was the design of stream-gaging net-works. In the siting of stations within its hydrological data system, the Colombian service faced three alternatives: (a) siting according to water use projects; (b) establishment of a minimal national network of basic stations; and (c) establishment of an optimal national network. Considering the existing facilities and the funds available, (b) was the alternative chosen. In the distribution of the stations, the predominant criterion was the establishment of a network that would yield indirect basic informa a network that would yield indirect basic information for any point in the territory by regression of measured data with genetic factors of the hydrological regime. (See also W73-14550) (K-napp-USGS) W73-14552

AN APPLICATION OF THE INADEQUATE HYDROLOGICAL DATA OF THE AFRICAN TROPICAL REGIONS IN ENGINEERING DESIGN.

National Council for Scientific Research, Lusaka (Zambia)

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 29-39, 1973. 4 fig, 1 tab, 7 ref.

Descriptors: \*Data collections, \*Network design, Descriptors: "Cost-benefit analysis, Project planning, Decision making, Gages, Instrumentation, Hydrologic data, Water measurement, Stream gages, Rain gages, Precipitation gages.

Identifiers: "Inadequate hydrologic data, "Zam-

Hydrological data available in African tropical regions usually consist of long precipitation records, rather short water level and discharge records and very short data for small, separated experimental catchments. No data from nearby, intensively ob-

served basins are usually available. In most cases, where the extension of the existing network and improvement of the quality of the records is not technically possible, at least a system of representative/experimental catchments within a main basin should be established, supplying the data and information on those regionally specific phenomena which cannot be transferred from experiments in the catchments of developed countries. In most cases the influence of vegetation, morphology, and soil types on the hydrological cycle should be investigated. Intensive field surveys particularly during the occurrence of ex-tremes, together with the tracing of historical records, can supply valuable additional informa-tion. (See also W73-14550) (Knapp-USGS) W73-14553

SHORT DURATION RAINFALL DEPTH-DUR-ATION-FREQUENCY MAP OF INDIA, Assam State Electricity Board, Barapani (India).

A. C. Goswami.

In: Decisions with Inadequate Hydrologic Data; in: Decisions with inacquate hydrologic Data, Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 48-56, 1973. 6 fig, 11 ref.

Descriptors: \*Depth-area-duration analysis, \*Data collections, \*Frequency analysis, Statistical methods, Duration curves, Hydrologic data. Identifiers: \*India, \*Inadequate hydrologic data.

Short duration rainfall data are extremely scarce in developing countries like India. Thus short dura-tion rainfall data for India are developed on the basis of rainfall relationships of other countries. The analysis is concerned only with durations of 2 hours or less, and all data are for point rainfall. U.S.A. rainfall ratios were used to develop the depth-duration-frequency maps of India from the 2 year, 24-hr rainfall isopleth map of India. (See also W73-14550) (Knapp-USGS)

COMPUTATIONS OF PEAK FLOODS WITH IN-ADEQUATE HYDROLOGIC DATA, Columbia Univ., New York.

G. J. Halasi-Kun.

In: Decisions with Inadequate Hydrologic Data; Poroceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 57-73, 1973. 6 fig, 12 ref.

Descriptors: "Peak discharge, "Rainfall-runoff relationships, "Hydrogeology, "New Jersey, Ur-banization, Flood forecasting, Data collections, Surface-groundwater relationships, Lakes, Swamps, Forests, Floods, Hydrologic data. Identifiers: "Inadequate hydrologic data.

A detailed investigation of the 100-year peak flood flow in New Jersey from areas less than 100 sq mi was based on the study of the hydroegology of the area. The results are compared with peak flood flow equations from Central Europe and the United States. From evaluation of point rainfall in-tensity and hydrogeologic qualities, diagrams and a basic runoff formula are developed for New Jer-sey. The entire State is divided into 10 hydrogeologic regions. Local corrections of the formula are established for the influence of lakes, swamps, wooded areas, shape of the watershed, and urbanization upon the 100-year peak runoff. (See also W73-14550) (Knapp-USGS) W73-14556

DETERMINATION OF SOME HYDROLOGI-CAL FACTORS WITH A WELL RECORDER, Ain Shams Univ., Cairo (Egypt). M M Soliman

### Group 2A-General

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 74-79, 1973. 2 fig, 1 tab, 3 ref.

Descriptors: \*Storage coefficient, \*Groundwater movement, \*Aquifer testing, Drawdown, Data collestions, Water level fluctuations, Aquifer characteristics, Transmissivity, Hydrologic data. Identifiers: \*Inadequate hydrologic data.

A new equation is presented to obtain storativity of an aquifer with the help of recorder readings. A confined aquifer is replenished from a remote source such as a lake or a river. A well is located at some distance from the replenishing source and completely penetrates the aquifer. The water-level recorder in a single well is a substitute for observation wells. Piezometric groundwater contours are also essential for this method. Pumping tests from the single well should be carried out to get the aquifer transmissivity before establishing a water level recorder. (See also W73-14550) (Knapp-USGS) W73-14557

THE USE OF TRACER DATA IN INCREASING THE INFORMATION ON HYDROLOGIC SYSTEMS,
Weizmann Inst. of Science, Rehovot (Israel).

Isotope Dept.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 80-87, 1973. 2 fig, 19 ref.

Descriptors: \*Tracers, \*Hydrologic cycle, Hydrogeology, Tritium, Carbon radioisotopes, Deuterium, Runoff, Stable isotopes, Oxygen isotopes, Streamflow, Hydrologic data, Ground-water movement, Data collections. Identifiers: \*Inadequate hydrologic data.

A review of tracer methods and new results in the field of stochastic treatment of tracer data is presented and evaluated in terms of additional information gained in hydrologic systems. Their contributions are in: (a) determination of specific hydrologic parameters; (b) confirmation or elimination of assumed models; (c) extension of hydrological data as used in system analysis; (d) formation of a connecting linkbetween system analysis and physical hydrology; and (e) supply of preliminary information on regional hydrological systems in the absence of hydrologic data. Examples of these uses are given. (See also W73-14550) (Knapp-USGS) W73-14558

CONCEPT OF A TECHNIQUE FOR AN ANALY-SIS OF WATERSHED RUNOFF EVENTS, Agricultural Research Service, Riesel, Tex. Soil

and Water Research Div. J. R. Williams.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 111-120, 1973. 4 fig. 8 ref.

Descriptors: \*Rainfall-runoff relationships. \*Hydrograph analysis, Unit hydrographs, Computers, Optimization, Data collections, Hydrologic data, Flood forecasting. Identifiers: \*Inadequate hydrologic data.

An optimization technique computes hydrologic variables that cannot be measured directly. Measured rainfall rates and storm hydrographs are used to compute unit hydrograph shapes and as-sociated source runoff from complex storms. Optimized unit hydrographs vary considerably for

different storms on the same watershed. These computed unit hydrographs can be used to develop relationships between unit hydrograph shape parameters and storm and watershed charac-teristics. The computed incremental source runoff can be used to develop and test infiltration equations for watersheds. Such equations should be more accurate in predicting source runoff from watersheds than equations developed with infiltrometer data. The optimization technique is efficient, as it will fit most storm hydrographs accurately with a moderate amount of computer time. (See also W73-14550) (Knapp-USGS)

EXPERIENCE WITH A MONTHLY RAINFALL--RUNOFF TRANSFER FUNCTION MODEL, Lahmeyer International G.m.b.H., Frankfurt am

Main (West Germany). F. Fahlbusch, and T. C. Muir.

In: Decisions with Inadequate Hydrologic Data; in: Decisions with inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 121-131, 1973. 4 fig. 2 tab, 11 ref.

\*Rainfall-runoff \*Mathematical models, Optimization, Computers, Parametric hydrology, Systems analysis, Water storage, Data collections, Hydrologic data. Identifiers: \*Inadequate hydrologic data.

A monthly rainfall-runoff model can be used for the determination of synthetic long-term sequences from synthetic or observed rainfall sequences on catchments for which only limited runoff data are available. A transfer function of an exponential decay type is used in a linear model linking rainfall as imput and runoff as output. A modification of the model to include the effects of onlinearity is proposed. Results of the application of both the linear and nonlinear models to five rivers are presented. (See also W73-14550) (K-napp-USGS) W73-14560

THE USE OF EVOP AS A HYDROLOGIC TOOL

British Columbia Univ., Vancouver, Dept. of Civil

Engineering. R. Y. McNeil, and S. O. Russell.

R. Y. McNeil, and S. O. Russell.
In: Decisions with Inadequate Hydrologic Data;
Proceedings of 2nd International Symposium in
Hydrology, September 1972, Fort Collins,
Colorado: Water Resources Publications, Fort
Collins, p 132-142, 1973. 2 fig, 1 tab, 1 ref.

Descriptors: \*Mathematical models, \*Optimization, Computer programs, Systems analysis, Data collections, Hydrologic cycle, Hydrologic data, Water balance

Identifiers: \*Inadequate hydrologic data

Practicing hydrologists are often faced with the problem of making decisions on the basis of in-adequate data. Simple hydrologic models offer one of making the most of the available data and at the same time lend themselves to sensitivity analysis. Evolutionary Operation (EVOP), developed as a practical method for improving the operation of chemical plants, can be adapted and used as a technique for optimization of hydrologic models. The basis of EVOP is that factorial experiments are run and results are displayed in a special format which is readily comprehensible to the operator, allowing him to improve his operation, while keeping in full control. When used with hydrologic models the same advantages apply, and the hydrologist can keep fully in control of his model at all times. EVOP allows several objectives to be considered simultaneously. Thus by carefully choosing the error indicators, it can be used as a diagnostic as well as an optimization tool. EVOP allows the parameters in any hydrologic model to be quickly optimized and the model thus

pushed to its limit. (See also W73-24550) (Knapp-USGS) W73-14561

A SIMULATION TECHNIQUE OF MONTHLY RUNOFF BY USE OF PRECIPITATION TIME SERIES AT MULTISTATIONS, Hokkaido Univ., Sapporo (Japan). Dept of Civil

Engineering. K. Hoshi, and I. Yamaoka.

R. Hoshi, and J. Tamaoka.

In: Decisions with Inadequate Hydrologic Data;
Proceedings of 2nd International Symposium in
Hydrology, September 1972, Fort Collins,
Colorado: Water Resources Publications, Fort
Collins, p 143-153, 1973. 1 fig. 4 tab, 3 ref.

Descriptors: \*Simulation analysis, \*Time series analysis, \*Stochastic processes, Data collections, Mathematical models, Hydrologic data, Rainfallrunoff relationships, Statistical models. Statistics, Variability, Identifiers: \*Inadequate hydrologic data.

The application of simulation techniques is particularly valuable as water resources planning problems become more complex. However, one of the difficulties encountered in practice is that in many cases decisions regarding water resources developments must be based on inadequate data both in time and in space. To overcome this situation, multivariate statistical procedures are based on stochastic processes consisting of both deterministic components and random components. Some procedures discussed are simultaneous generation of monthly precipitation at several satellite stations from a key station; determination of areal precipitation for a specified month as the actual inputs to the runoff system; simultaneous generation of monthly runoff at given stations with incorporation of areal precipitation to improve the simulation models; and adoption of matrix representation, which is a very useful strategy for evaluating the complex interrelationships of tial and temporal variations of hydrologic events in watershed models and for minimizing stochastic random components. (See also W73-14550) (K-napp-USGS) W73-14562

ON THE USE OF SHORT-TERM DATA FOR STREAMFLOW SYNTHESIS, Pittsburgh Univ., Pa. Dept. of Civil Engineering.

R. G. Quimpo.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 154-160, 1973. 2 fig, 15 ref.

Descriptors: \*Mathematical models, \*Statistical models, \*Rainfall-runoff relationships, Parametric hydrology, Synthetic hydrology, Stochastic processes, Data collections, Hydrologic data, Markov processes larkov processes. Identifiers: \*Inadequate hydrologic data

The generation of streamflow sequences from which the distribution of design variables in water resources planning are determined requires the estimation of stochastic parameters from relatively long hydrologic records. When hydrologic data are inadequate, a possible alternative is to make use of the relation between parametric and stochastic models to deduce parameters from short-term rainfall-runoff events. Using basin storage properties as common determinants characterizing both models, a scheme is outlined whereby information from short duration hydrographs may be employed to obtain a model for generating streamflows. The concepts may be applied to both Markov and non-Markov models. (See also W73-14550) (Knapp-USGS) W73-14563 A SIMILAR STORM METHOD ON FILLING DATA VOIDS,

Tokushima Univ., (Japan). Dept. of Engineering. M. Hashino.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 161-173, 1973. 6 fig. 2 tab, 1 ref.

Descriptors: \*Hydrologic data, \*Rainfall, \*Storms, Regression analysis, Statistical methods, Rain gages, Data collections. Identifiers: \*Inadequate hydrologic data, Similar

The concept of 'similar storm' is introduced for estimation of missing rainfall sequences on the assumption that storms missing in the record exist as 'historic storms'. A group of gaging sites, which have similar rainfall characteristics, is selected to include a given site with storm data voids. The most similar storm to a given void storm at the site is selected on the basis of coefficient matrices of areal cross-correlation obtained from historic rainfall data of many storms. It is necessary that the rainfall sequences of the storm considered be perfectly observed at several sites of the selected gaging group except the site concerned. The rainfall sequence of the void storm at the given site is obtained from linear regression analysis using the wimilar storm and the partial void storm. (See also W73-14550) (Knapp-USGS)

ANALYSIS OF MONTHLY RAINFALL PROBA-BILITIES BY WEIGHTED TRANSFORMA-TION,

Engineering Consultants, Inc., Denver, Colo.

Y. Au-Yeung. In: Decisions with Inadequate Hydrologic Data: In. Decisions with inaccutate hydrologic Data, Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 174-181, 1973. 4 fig, 4 tab, 2 ref.

Descriptors: \*Rainfall, \*Probability, Statistical methods, Data collections, Hydrologic data, Dis-

tribution patterns. Identifiers: \*Inadequate hydrologic data.

Reliable rainfall probability estimates are essential for irrigation project planning and decisionmaking, especially where data are inadequate or limited. A simple and versatile method for analyzing monthly rainfall probability uses a combination of three types of data transformation and the mixed dis-tribution method to transform monthly rainfall data. The three types of data transformation are normal, log-normal, and square-root. Application of the method is shown in an example using the monthly rainfall data of Kabinburi Weather Station in Thailand. Results indicate that a best fit distribution for the observed monthly rainfall data can easily be obtained. (See also W73-14550) (K-napp-USGS) W73-14565

EVALUATION OF MULTIANNUAL FIRM HYDROELECTRIC POWER--A NEW METHOD, Hidrotecnica Portuguesa, Lisbon. Dept. of Civil Engineering.

A. A. Manzanares, J. Santos, and L. V. Tavares A.A. Manzanares, J. Santos, and L. V. Iavares.
In: Decisions with Inadequate Hydrologic Data;
Proceedings of 2nd International Symposium in
Hydrology, September 1972, Fort Collins,
Colorado: Water Resources Publications, Fort
Collins, p 205-209, 1973. 2 ref.

Descriptors: \*Water yield, \*Reservoir yield, \*Safe L'escriptors: water yield, "Keservoir yield, "Sale yield, "Time series analysis, System analysis, Regulation, Water storage, Hydroelectric power, Data collections, Hydrologic data. Identifiers: "Inadequate hydrologic data. A method is presented to evaluate the firm power produced by complex hydroelectric systems with large multiannual reservoirs. If the known sample of annual energetic inflows is scarce and the guarantee is defined over a long period, this method is preferable to those currently used. In-stead of studying the accumulated annual inflows, the series of multiannual inflows is analyzed. Monte Carlo techniques are used to estimate variables with small variances. (See also W73-14550) (Knapp-USGS) W73-14566

INADEQUATE HYDROLOGIC DATA AND RESERVOIR CAPACITY,

Monash Univ., Clayton (Australia). Dept. of Civil

Engineering. T. A. McMahon, and G. P. Codner.

11. A. McManon, and G. F. Couner.

In: Decisions with Inadequate Hydrologic Data;
Proceedings of 2nd International Symposium in
Hydrology, September 1972, Fort Collins,
Colorado: Water Resources Publications, Fort
Collins, p 210-219, 1973. 5 tab, 11 ref.

Descriptors: \*Reservoir storage, \*Streamflow forecasting, \*Data collections, Statistical methods, Probability, Hydrologic data, Time series analysis, Distribution patterns, Statistical

Identifiers: \*Inadequate hydrologic data

Inadequate streamflow data result from measurement errors and shortness of record. Sampling er-rors which follow from inadequate data are ex-amined for their effect on streamflow generation models and storage analysis. The effect on storage estimates of assuming different inflow idstributions is also considered. The comparative sig-nificance of absolute errors resulting from inadequate specification of means, skews, and serial correlations is also discussed. In general, 36 years of record is adequate. For the distribution study, two- and three-parameter log-normal models, a log transformed data model, and one based on the historical distribution of the random component were compared on the basis of replicated flow parameters and storage estimates. No distribution produced satisfactory results for all rivers. Preservation of the mean flow is more important that the serial correlation. Because of the effect of implied skew, care should be taken in using the twoparameter log-normal distribution in data genera-tion models. (See also W73-14550) (Knapp-USGS) W73-14567

EFFECTS OF INADEQUACE OF HYDROLOGIC DATA ON RELIABILITY OF WATER RESOURCES DESIGN, Osaka Univ. (Japan). Dept. of Civil Engineering. A. Murota, and T. Eto.
In: Decisions with Inadequate Hydrologic Data;

Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 220-237, 1973. 9 fig, 1 tab, 1 ref.

Descriptors: \*Data collections, \*Hydrologic data, \*Reservoir design, Systems analysis, Safe yield, Streamflow forecasting, Hydrograph analysis, Simulation analysis.

Identifiers: \*Inadequate hydrologic data

Inadequacy of hydrologic data severely effects the reliability of design. An approximate method for calculating a linear reservoir system equivalent to a general reservoir system is given. The proposed method of linearization may simplify the analytical treatment of the reservoir system and make analytical studies of the total system possible, while maintaining qualitative behavior of the actual reservoir system. Gross shortage of water that reservoir system. Oross shottage of water through the observation period was evaluated. An equation was deduced to represent the relation between the shortage and sample size, mean, stan-dard deviation and autocorrelation coefficient of natural discharge sequences, the capacity of the reservoir, and the target draft. By using the equation and simulation, effects of error in observation and sample size of discharge data on reliability of a water resources design were investigated. (See also W73-14550) (Knapp-USGS)

EVALUATION OF DROUGHT EFFECTS AT LAKE ATITLAN, Hydrologic Eignieering Center, Davis, Calif. A. D. Feldman.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 238-251, 1973. I fig. 3 tab, 6 ref.

Descriptors: "Water balance, "Reservoir evapora-tion, "Reservoir yield, "Hydrologic data, Data col-lections, Mathematical models, Simulation analy-sis, Synthetic Advology, Water level fluctuations. Identifiers: "Inadequate hydrologic data, "Lake Atitlan (Guatemala).

Guatemala's Lake Atitlan is a natural sink for a small watershed which lies in the central highlands small watershed which lies in the central highlands adjacent to the Pacific coastal plain. Guatemala plans to develop hydropower from this lake by tunneling through the southern boundary of the lake to develop head down the coastal slope. Streamflows from nearby basins will be diverted into the lake to replace lake water used for hydropower. Limited data are available for streamflow, precipitation, and lake surface elevations, but there is no lake evaporation or seepage. tions, but there is no lake evaporation or seepage. The lake elevation record is 25 years long, while precipitation and streamflow data in the study area range from 1 to 9 years. In order to simulate the operation of the lake during the historical period, it was necessary to estimate the natural water balance of the lake as well as the missing records of the streamflows at the diversion sites. Because of the lack of evaporation and seepage data, changes in lake storage as reflected by changes in lake elevation were used to represent the natural water balance of the lake. The missing streamflow records could be reconstructed using the change in the lake elevation. (See also W73-14550) (Knapp-USGS) W73-14569

THE HYDROLOGICAL FEASIBILITY

THE HYDROLOGICAL FEASIBILITY OF VARIABLE WATER SUPPLY POLICIES, Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div. J. Bargur, and M. Gablinger.

In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 252-265, 1973. 3 fig, 10 ref.

Descriptors: \*Water supply, \*Variability, \*Water resources development, Linear programming, Mathematical models, Simulation analysis, Water policy, Data collections, Water management (Applied), Water yield, Hydrologic data.
Identifiers: \*Inadequate hydrologic data, \*Israel.

In regions where scarcity of water resources is increasing and thus marginal quantities of water are becoming more important, it seems possible to inbecoming more important, it seems possible to in-crease the long-run regional water potential by establishing a variable water supply policy. To study this policy, a combination of linear pro-gramming and siumlation models was applied in a two-stage program. The hydrological feasibility of two-stage program. The hydrological feasibility of variable water supply opticies was tested using the Israel water supply system as a case study. Under a variable supply policy the average annual allocation can be increased by more than 10% and the stipulated allocation can be met 98% of the time. (See also W73-14550) (Knapp-USGS) W73-14570

### Group 2A-General

WATER BALANCE IN EUROPE (VODNYY BALANS YEVROPY), Akademiya Nauk SSSR, Moscow. Institut

G. M. Chernogayeva. Izdatel'stvo Vsesoyuznyy Institut Nauchnoy i Technicheskoy Informatsii, Moscow, 1971. 140 p.

Descriptors: \*Europe, \*Water balance, \*Water resources, Hydrologic cycle, Precipitation (Atmospheric), Evaporation, Runoff, Surface runoff, Subsurface runoff, Groundwater, Soil water, Glaciers, Mountains, Hydrographs, Sea level, Elevation, Maps, Equations, Estimating, Investigations.

Identifiers: USSR, Alps.

This monograph is the second in a series of publications on continental water balances and was prepared by the Department of Hydrology of the USSR Academy of Science's Institute of Geog-raphy. A method developed at the Institute for water-balance studies is based on solution of a system of differentiated equations characterizing e lithogenic component of the hydrologic cycle, including groundwater and soil water. Maps are compiled for total river runoff, subsurface and surface runoff, evaporation, and total moisture, and relations are established between water-balance items and sea-level elevation for different regions in the Alps. Balance estimates are given of water resources for each European country and for economic regions in the European part of the USSR. (Josefson-USGS) W73-14598

IS THERE AMPLE FRESHWATER ON EARTH, (MNOGO LI PRESNOY VODY NA ZEMLE), Akademiya Nauk SSSR, Moscow. Ins Geografii. M. I. Lvovich.

Priroda, No 5, p 7-17, 1973. 8 fig, 1 tab.

Descriptors: \*Freshwater, \*Water resources, Descriptors: "reshwater, "water resources, "Water balance, "Hydrologic cycle, Precipitation (Atmospheric), Runoff, Subsurface runoff, Sur-face runoff, Soil water, Evaporation, Water sources, Geographical regions, Africa, Maps, Equations Identifiers: \*USSR, Hydrosphere, Water exchange

The hydrologic cycle has provided man with abundant freshwater resources, although natural condi-tions in certain regions have produced acute water shortages. Moreover, improper use of water has led to pollution of streams and other water bodies. Revamping of principles and approaches toward use and conservation of water will solve the problem of the world's water supply. Relations of evaporation and subsurface runoff to total soil moisture for the USSR and of total runoff to precipitation for Africa and graphed; water balance and freshwater resources of continents balance and resulvated resources of Comments are tabulated; and total runoff, subsurface runoff, surface runoff, total soil moisture, and evapora-tion of world land areas are mapped. (Josefson-USGS) W73-14602

THEORETICAL ANALYSIS OF THE ROLE OF SUBSURFACE FLOW IN THE GENERATION OF SURFACE RUNOFF: 2. UPSTREAM SOURCE AREAS,

IBM Watson Research Center, Yorktown Heights,

N.Y. R. A. Freeze. IBM Research Report RC 3795, March 22, 1972. 32 p, 11 fig. 25 ref. OWRR C-3144 (No 3694) (4).

Descriptors: \*Subsurface runoff, \*Streamflow, \*Groundwater movement, \*Rainfall-runoff relationships, \*Hydraulic models, Hydrologic data, Correlation analysis, Theoretical analysis, Mathematical studies, Environmental effects, Topography, Geomorphology, Soil types, Overland

flow, Infiltration, Inflow, Hydrogeology, Base flow, Unsaturated flow, Saturated flow.

Runoff simulations for hypothetical upstream source areas, carried out with a deterministic mathematical model that couples channel flow and saturated-unsaturated subsurface flow, provide saturated unsured to the runoff-generating mechanisms observed in the field by Ragan (1968) and Dunne (1970). The simulations show that there are stringent limitations on the occurrence of sub are stringent infinitations on the occurrence of sub-surface stormflow as a quantitatively-significant runoff component. It is a feasible mechanism only on convex hillslopes that feed deeply-incised channels, and then only when saturated soil conductivities are very large. On concave slopes with lower permeabilities, and on all convex slopes, hydrographs are dominated by direct runoff via very short overland flow plaths from precipitation on transient, near-channel wetlands. On these wetlands, surface saturation occurs from below due to lands, surface saturation occurs from below due to rising water tables that are fed by vertical infiltra-tion rather than by lateral subsurface flow. Classic Hortonian overland flow is a rare occurrence in time and space. These conclusions have implications in the planning of field instrumentation networks, and in the design of hydrologic response models. (See also W72-10905 and W73-00668) (Woodard-USGS)

A NUMERICAL MODEL OF A FJORD ESTUA-RY. I. BASIC CONSIDERATIONS AND PROPOSED FINITE DIFFERENCE SCHEMES, Alaska Univ., College. Inst. of Marine Science. For primary bibliographic entry see Field 02L. W73-14619

HIGH YIELD FROM THE BULL RUN

WATERSHED, British Columbia Dept. of Municipal Affairs, Vic-toria. Environmental Planning and Management

L. V. Luchin.

Journal of the American Water Works Associa-tion, Vol 65, No 7, p 183-186, March 1973. 2 tab.

Water Descriptors: balance. \*Watersheds (Divides), \*Watershed management, \*Evapotranspiration control, Precipitation (Atrevaportals planton Control, Prespiration (Amospheric), Evaportanspiration, Soil moisture, Evaporation, Water yield, \*Oregon. Identifiers: \*Bull Run Watershed (Ore), Interception Loss, Mount Hood National Forest.

A water balance equation was used for calculating A water balance equation was used for calculating the amount of runoff in the Bull Run watershed in Mt. Hood National Forest, about 25 miles east of Portland, Oregon. Calculated runoff was then compared with measured runoff. Calculated runoff was 84.22 inches annually, while measured runoff was 102.56 inches - 20% higher than expected. The difference of about 18 inches is explained nartly as un to 9 inches of calculation explained nartly as un to 9 inches of calculation explained partly as up to 9 inches of calculation ror, and partly as water seepage into the Bull Run watershed from adjoining basins. Porous bedrock underlying the area and measurements on three small tributaries support the latter conclusion. The excess of measured runoff over calculated runoff led to the conclusion that Bull Run was a highled to the conclusion that Bull Run was a "high-yield' watershed. The equation for computing ru-noff is  $X\pm a$ -b-c-d-e, where  $X\pm$  calculated generated water, a  $\pm$  gross or measured precipita-tion, b  $\pm$  interception loss, c  $\pm$  evaportanspiration loss, d  $\pm$  soil moisture storage change, and e  $\pm$ evaporation from free water surfaces. Limited de-forestation is suggested as a means of increasing water yield, but reservations are expressed about impact of deforestation on other watershed resources. (Stein-North Carolina) W73-14687

NEW APPROACHES TO WATER-RESOURCES INVESTIGATIONS IN UPSTATE NEW YORK, Geological Survey, Albany, N.Y.

For primary bibliographic entry see Field 02F. W73-14709

### 2B. Precipitation

MULTISPECTRAL REMOTE SENSED IMAGE ANALYSIS BY A SPECIAL ELECTRONIC SYSTEM. Stanford Research Inst., Menlo Park, Calif. For primary bibliographic entry see Field 07B. W73-14338

RELATIVE DETACHABILITY OF SOIL PARTI-CLES BY SIMULATED RAINFALL, Forest Service (USDA), Ogden, Utah. Intermoun-tain Forest and Range Experiment Station. For primary bibliographic entry see Field 02J. W73-14414

THE PROBLEM OF ASSESSING THE EROSIVE POWER OF RAINFALL METEOROLOGICAL OBSERVATIONS. Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils. For primary bibliographic entry see Field 02J. W73-14415

HYDROMETEOROLOGICAL INVESTIGA-TIONS IN KAZ (GIDROMETEOROLOGICHESKIYE KAZAKHSTAN LEDOVANIYA V KAZAKHSTANE). Kazakhskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, (USSR).

Nauchno-Issledovatel'skiy Kazakhskiy Gidrometeorologicheskiy Institut Trudy, No 36, Leningrad, N. F. Gel'mgol'ts, editor, 1970. 196 p.

Descriptors: "Investigations, "Meteorology, "Climatology, "Precipitation (Atmospheric), "Runoff, Flood discharge, Time of concentration, Permafrost, Glaciers, Mountains, Mudflows, Sands, Vegetation, Water resources, Air pollution, Synoptic analysis, Weather forecasting, Weather modification, Correlation analysis, Bibliographies. Identifiers: USSR, \*Kazakhstan, Aerology.

Development of hydrometeorological studies in Kazakhstan from early post-revolutionary years to the present is reviewed in this commemorative issue published by the Kazaky Hydrometeorological Scientific Research Institute (KazNIGMI) on the occasion of the 50th anniversary of the founding of the Kazakh Soviet Socialist Republic. In-dividual papers deal with structural analysis and forecasting of climatic fluctuations; structure of long-term annual precipitation frequence; spatial distribution of precipitation and its consideration in storm runoff computations; calculation of maximum storm-flood discharges; calculation of concentration time in a mountain basin; climatic characteristics of Alma-Ata and their role in polluting the atmosphere of the city; agrometeorok luting the atmosphere of the city, agroineteosorgi-cal studies of pasture vegetation in Kazakhstan; size distribution of soil particles in southern Kazakhstan as a result of aeolian processes; medi-AZZARISTAM as a result of accurant processes; meurical and climatic conditions in lowland and mountain regions of southern Kazakhstan, etc. A bibliography of monographs, transactions, observation data, manuals, and other literature published by KazNIGMI is appended. (Josefson-USGE) USGS)

CONCENTRATION RATIOS OF SALTS AT THE SEA SURFACE AND IN RAINWATER COL-LECTED OVER THE SEA (SOOTNOSHENIVE KONTSENTRATSIY SOLEY NA POVERKH-NOSTI OKEANA IV MORSKOY ATMOSFER-NOY VLAGE), A V MURSKUY ATMOSFER-NOY VLAGE), Akademiya Nauk SSSR, Moscow. Institut Oke-anologii.

For primary bibliographic entry see Field 02K. W73-14435

STUDY OF URBAN EFFECTS ON PRECIPITA-TION AT ST. LOUIS, Illinois State Water Survey, Urbana

S. A. Changnon Jr. April 1973. 34 p, 17 fig, 10 tab, 11 ref. NSF GI-

Descriptors: "Weather, "Urbanization, "Environ-mental effects, Weather modification, Weather patterns, Missouri, Data collection, Weather forecasting. Identifiers: "St. Louis (Missouri).

The effects of an urban environment on climate were studied at St. Louis, Missouri. The study centered on 14 goals, including: (1) a study of surface rainfall and severe weather to define their time and space distribution and delineate any anomalies. (2) the investigation of low level airflow and circulation patterns, (3) urban water quality, (4) synoptic weather analyses, (5) definition of the causes of anomalies, (6) local and regional planning incorporating man-made weather changes, (7) improvements in local weather changes, (7) improvements in forecasting, (8) air pollution studies, (9) planning for weather modification, (10) relevance of weather anomalies to water resources, hydrologic designs, agriculture, ecology and business, and (11) transfer of knowledge and technology to other disciplines. The results are presented of the previous year's activities for each of the goals supported by the National Science Foundation. Sig-nificant influences of the urban environment on weather patterns were discovered. (Poertner) W73-14539

NEW METHOD OF FORECASTING MUD-FLOWS FROM THUNDERSTORMS (NOVYY METOD PROGNOZIROVANIYA SELEVYKH POTOKOV PO GROZAM), Akademiya Nauk SSSR, Moscow. Institut

For primary bibliographic entry see Field 02J. W73-14599 Geografii.

NOTE ON THE KINETIC ENERGY SPECTRUM

OF COASTAL WINDS, Oregon State Univ., Corvallis. Dept of Oceanog-

raphy.
D. E. Frye, S. Pond, and W. P. Elliott. Monthly Weather Review, Vol 100, No 9, p 671-673, September 1972. 2 fig, 7 ref. ONR N00014-67-A-0369-0007.

Descriptors: \*Coasts, \*Winds, \*Sea breezes, \*Land breezes, Climates, Kinetics, \*Oregon. Identifiers: Power density spectrum, Land-sea temperature differences, \*Kinetic energy (Winds).

This study was conducted to determine if the power density spectrum of coastal winds contained the same spectral gap, where there is very little eddy kinetic energy, as has been found in some localities. An examination of the spectrum of winds along the Oregon coast shows a major diurmallop and the period of 24 hr and a small microscale peak at a period of 24 hr and a small microscale peak at about 50 hrs. The 24-hr peak is thought to be associated with the diurnal variation of land-sea temperature difference. (Sinha - OEIS) W73-14642

PERIODIC MOTIONS OF THE SEASONAL THERMOCLINE ALONG THE SOUTHERN CALIFORNIA COAST,
Naval Electronics Lab. Center, San Diego, Calif.
For primary bibliographic entry see Field 02E.
W73-14646

### 2C. Snow, Ice, and Frost

FINAL REPORT ON DRIFT STATION BIOLO-

GY: ZOOPLANKTON TAXONOMY AND SORT-ING PROGRAMS, University of Southern California, Los Angeles. Dept. of Biological Sciences. For primary bibliographic entry see Field 021. W73-14312

METALLOGENIC SIGNIFICANCE ALASKAN GEOSTRUCTURES SEEN ON NIM-BUS AND ERTS IMAGES, For primary bibliographic entry see Field 07C. W73-14331

THE PHYSICAL MEANING OF TWO-DIMENSIONAL STRESSES IN A FLOATING ICE

Washington Univ., Seattle. Div. of Marine Resources. J. F. Nye.

AIDJEX Bulletin No 21, University of Washington, Division of Marine Resources, p 1-8, July 1973, 4 ref.

Descriptors: \*Sea ice, \*Deformation, \*Rheology, Stress, Strain, Stress analysis.

A conceptual difficulty is presented by two-dimensional models of sea-ice cover. The real ice cover is three-dimensional. How to relate the two-dimensional stresses in the models to the real threedimensional stresses needs to be resolved before the physical plausibility of any proposed twodimensional rheology can be determined. If a three-dimensional incompressible viscous continuum floating on water were looked at as a twodimensional continuum, the two-dimensional medium would appear to have a bulk viscosity equal to three times its shear viscosity; the twodimensional stresses would have to be related to the three-dimensional stresses by a function of thicknesses; and the momentum equations would not be valid since they omit the derivatives of potential energy. (Knapp-USGS) W73-14399

THE MEANING OF TWO-DIMENSIONAL STRAIN-RATE IN A FLOATING ICE COVER, Univ., Seattle. Div. of Marine Resources.

J. F. Nye. AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 9-17, July 1973. 3 fig. 2 ref.

Descriptors: \*Sea ice, \*Rheology, \*Strain measurement, \*Deformation, \*Instrumentati Variability, Strain gages, Measurement, Strain. \*Instrumentation.

The AIDJEX main experiment includes the mea-surement of strain in the icepack on certain scales, and it is proposed to model the ice as a two-dimensional continuum. The strains are to be measured by observing the change in position of points fixed in the ice, or by measuring the change in separation of such points. The existence of leads, pressure ridges, and other features shows that the deformation of the icepack is inhomogeneous or discontinuous on the scale of these features; so the result of a measurement may depend somewhat on the precise relation between a measurement point and some local feature. Velocity variations exist on virtually all scales; it is necessary to instrument on a scale appropriate to the scale of the deforma-tion to be measured. (Knapp-USGS)

IS THERE ANY PHYSICAL BASIS FOR ASSUM-ING LINEAR VISCOUS BEHAVIOR FOR SEA

ICE, Washington Univ., Seattle. Div. of Marine Resources.

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 18-19, July 1973.

Descriptors: \*Sea ice, \*Rheology, \*Strain measurement, \*Deformation, \*Instrumentation, Variability, Strain gages, Measurement, Strain.

A number of models for the large-scale behavior of the arctic sea ice use a linear viscous law for the interaction of the ice with itself. There is no sound evidence, either from the degree of success of these models or from independent sources, that the ice behaves in a viscous manner. Ice probably exhibits brittle behavior under tension, combined with strain-hardening behavior under compression. Strain-hardening under compression, by the successive crunching of thicker ice, would be consistent with the Parmerter-Coon ridging model. Although the ice, modeled as a continuum, is brit-tle or plastic on time scales of days or weeks, it may nevertheless appear to be viscous on longer time scales. Large random stresses from storms fracture the ice, and the small, long-term steady stress can take advantage of the favorable opportunities so presented. Nothing more happens until the next storm, when the process is repeated. The viscosity' would be inversely related to the frequency and intensity of the storms, rather than being any intrinsic property of the ice. (Knapp-USGS) W73-14401

AN APPROACH TO COUPLING THE DYNAM-ICS AND THERMODYNAMICS OF ARCTIC SEA ICE,

Washington Univ., Seattle. Dept. of Atmospheric

G. A. Maykut.

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 23-29, July 1973. 3 fig. ONR Contract N00014-67-A-0103-0007 NSF

Descriptors: \*Sea ice, \*Thermodynamics, \*R-heology, \*Water balance, Deformation, Melting, Freezing, Ablation.
ldentifiers: \*Sea ice dynamics.

Thermodynamics influences the dynamic behavior of sea ice primarily through the formation of new ice on areas of open water, and through ablation and accretion on the horizontal boundaries of exand accretion on the norizontal boundaries of ex-isting ice. These mass changes are used in the mo-mentum balance equations and affect the material properties of the icepack. To satisfy the needs of proposed dynamic models, it is necessary to describe changes in the total mass, the area of open water, and the area of thin ice within specified regions. Thermodynamic models can predict growth rates as a function of ice thickness and season; however, the needs of advanced dynamic models cannot be met without some knowledge of the distribution of ice thickness. The continuous range of ice thicknesses is calculated as a number of discrete categories. Equations are as a number of unstreet exegures. Expansions are then developed to describe how the area covered by each category changes as a result of ice growth, advection, and divergence. The method is inde-pendent of any particular dynamic model since the only dynamic input required is the velocity field of the ice. (Knapp-USGS)

ON THE THICKNESS DISTRIBUTION OF SEA

ICE, Washington Univ., Seattle. Dept. of Atmospheric A. S. Thorndike, and G. A. Maykut.

### Group 2C-Snow, Ice, and Frost

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 31-47, July 1973. 11 fig. 3 ref. ONR Contract N00014-67-A-0103-0007 NSF Grant GV-28807.

Descriptors: \*Sea ice, \*Thermodynamics, \*R-heology, \*Water balance, Deformation, Melting, Freezing, Ablation. Identifiers: \*Sea ice dynamics.

A region on the surface of the Arctic Ocean may contain ice of many different thicknesses, the rela-tive proportions of which are described by an ice thickness distribution function. The ice thickness distribution regulates the heat exchange between the atmosphere and the ocean, it determines the navigability of ice-covered waters, and it determines the rheological properties of the icepack. The change in area of a region of sea ice results in a redistribution of ice within the region. In divergence, the ice breaks apart; rather than stretching and becoming thinner, it fails, creating open water. In convergence, the thinnest ice is crushed first and piled in some arbitrary way to create thicker, idged ice. (Knapp-USGS)

THE STEADY DRIFT OF A INCOMPRESSIBLE ARCTIC ICE COVER, Washington Univ., Seattle. Dept. of Atmospheric

Sciences.

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 49-77, July 1973. 11 fig, 1 tab, 29 ref. ONR N00014-67-A-0103-0007 NSF Grant GV-28807.

Descriptors: \*Sea ice, \*Stress, \*Strain, \*Ocean currents, \*Ocean circulation, Rheology, Deformation, Arctic Ocean. Identifiers: \*Sea ice drift.

The steady drift of sea ice in an idealized Arctic Basin was calculated assuming that the ice is in-compressible and inviscid. The momentum and continuity equations for the ice were solved for the velocity and the ice pressure. The boundary conditions require that no ice flow across coastal boundaries, but that ice flow out of the basin into the Greenland Sea and into the basin from the Kara Sea. The patterns of calculated velocities and vorticities are realistic, but their magnitudes are too high. When the wind stress is reduced to onethird the strength first assumed, realistic speeds and vorticities are obtained. The maximum calculated ice pressure is marginally able to ridge thick ice, according to the ridging model of Parmerter and Coon. These maximum values occur near Greenland where intense ridging is reported. (Knapp-USGS) W73-14404

DIFFERENTIAL SEA ICE DRIFT I: SPATIAL AND TEMPORAL VARIATIONS IN MESOSCALE STRAIN IN SEA ICE, Cold Regions Research and Engineering Lab., Hanover, N.H.

W.D. Hibler, W. F. Weeks, A. Kovacs, and S. F.

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 79-113, July 1973. 15 fig, 4 tab, 14 ref. NSF Grant AG-344.

Descriptors: \*Sea ice, \*Stress, \*Strain, \*Ocean currents, \*Ocean circulation, Rheology, Deformation, Arctic Ocean.
Identifiers: \*Sea ice drift.

Measurements of mesoscale strain in sea ice were carried out over a 5-week period in spring 1972 at the main AIDJEX camp in the Beaufort Sea. They were analyzed to determine inhomogeneities in the strain. A least squares strain tensor time series was also calculated. The least squares divergence between day 83 and 112 exhibited five significant strain events consisting of dilatation followed by convergence. Net areal changes were as large as 3%. Divergence rates were up to 0.12% per hour and shear rates were as large as 0.10% per hour. In the principal axis coordinate system, the events typically exhibited a much larger compression (or extension) along one axis than along the other. The average strain rate tensor could be calculated with rate magnitudes larger than the inhomogeneity variation. The inhomogeneity variation had a scale inversely with the square root of the average length of the strain lines and was only slightly dependent on frequency for frequencies above one cycle per day. Sampling intervals of up to 10 hours are generally adequate for resolving low-frequency strain rates. Low-frequency events show sigificantly greater spatial correlation than higher-frequency events. (See also W73-14406) (K-napp-USGS) W73-14405

DIFFERENTIAL SEA ICE DRIFT II: COM-PARISON OF MESOSCALE STRAIN MEA-SUREMENTS WITH LINEAR DRIFT THEORY

PREDICTIONS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
W. D. Hibler, III.
AIDJEX Bulletin No 21, Washington University

Division of Marine Resources, p 115-137, July 1973. 5 fig. 2 tab. 18 ref. NSF Grant AG-344.

Descriptors: \*Sea ice, \*Stress, \*Strain, \*Ocean currents, \*Ocean circulation, Rheology, Deformation, Arctic Ocean.
Identifiers: \*Sea ice drift.

The divergence rate and vorticity of sea ice drift follow the local pressure and wind divergence: for low atmospheric pressures and converging winds, tow atmospherer pressures and converging winds, the divergence rate is negative and the vorticity counterclockwise; for high pressures and diverging winds, the divergence rate is positive and the vorticity clockwise. This behavior agrees with predictions based upon the infinite boundary solution of linearized drift theory in the absence of gradient overant effects and wings the constitutive law. current effects and using the constitutive law proposed by Glen for pack ice. The infinite boun dary solution of the linear drift equation indicates that in a low-pressure region the ice converges for high compactness (winter) and diverges for low compactness (summer). Calculations were also carried out using a more general linear constitutive law which allows the viscosities to vary with tem-poral frequency and which includes as special cases a generalized Hookes law as well as the Glen law. A best fit of this more general calculation with strain measurements agrees better with viscous behavior than with elastic behavior, with the frequency dependence of the estimated viscosities approximating closely the Glen law behavior. (See also W73-14405) (Knapp-USGS)

SONAR MAPPING OF THE UNDERSIDE OF

PACK ICE, Wisconsin Univ., Middleton. Geophysical and Polar Research Center.

Polar Research Center.
T. K. Kan, C. S. Clay, and J. M. Berkson.
AIDJEX Bulletin No 21, Washington University
Division of Marine Resources, p 155-169, July
1973. 9 fig., 10 ref. ONR Contract N00014-67-A0128-0019.

Descriptors: \*Sea ice, \*Surveys, \*Sonar, Topography, Deformation, Instrumentation.
Identifiers: \*Sea ice ridges.

An under-ice survey was carried out in a pack icefield near Fletchers Ice Island (T-3) by means of a 48 kHz Kelvin Hughes transit sonar lowered through a hole. Five sets of data were collected and transformed into polar coordinate mosaics. The echo length, the shadow zone, the arrival time of echoes, and the sounding depth provide the basic information for interpretation. A complete under-ice map was constructed to show the dis-tribution of the under-ice features. The keel depths of the ridges have been estimated; the average ratio of the peak top elevation to the keel depths is 1:7.6. (Knapp-USGS) W73-14407

ARCTIC SEA ICE RIDGE FREQUENCY DISTRIBUTIONS DERIVED FROM LASER

Naval Oceanographic Office, Washington, D.C. Polar Oceanography Div. W. B. Tucker, III, and V. H. Westhall.

AIDJEX Bulletin No 21, Washington University Division of Marine Resources, p 171-180, July 1973. 5 fig, 2 tab, 5 ref.

Descriptors: \*Sea ice, \*Surveys, \*Topography, Deformation, Instrumentation, Profiles. Identifiers: Lasers.

Roughness characteristics of the sea-ice surface were obtained by using basic statistical techniques applied to laser profile data. Ice ridge frequency distributions were calculated for 3600 km of polar ice. Of the sections containing fewer than 0.5 ridges per kilometer, 90% were located off the Alaskan coast below 77 deg north latitude. Of the sections with more than 5.0 ridges per km, 82% were in the nearshore areas extending from northeastern Greenland through the Lincoln Sea and along the Canadian Archipelago to Banks Island. (Knapp-USGS) W73-14408

STUDY OF GLACIERS IN SIBERIA AND SOVIET FAR EAST DURING YEARS OF SOVIET RULE (IZUCHENIVE LEDNIKOV SIBIRI I NA DAL'NEM VOSTOKE ZA GOV SOVETSKOY VLASTI),

Institute of Geography of Siberia and the Far East, Irkutsk. (USSR).

L. N. Ivanovskiy. Institut Geografii Sibiri i Dal'nego Vostoka Doklady, No 26, p 54-60, Irkutsk, 1970. 32 ref.

Descriptors: \*Glaciology, \*Glaciers, Mountains, Ice, Snowpacks, International Geophysical Year, Investigations. Identifiers: USSR, \*Siberia, \*Soviet Far East.

Mountain-glacier investigations in Siberia and Soviet Far East are divided into 5 periods of glacier study: (1) the prerevolutionary period; (2) the period from the revolution to the International Polar Year (1932-33); (3) the period from the International Polar Year to the start of the International Geophysical Year; (4) the period of the International Geophysical Year; (4) the period of the International Geophysical Year (1957-59); and (5) the period following the International Geophysical Year. Excluding the Arctic, the territory is classified into Scaleriological regions with a total of stified into 5 glaciological regions with a total of 2,772 glaciers covering 2,385.9 sq km. Siberian glaciers comprise 34% of all glaciers in the USSR but occupy only about 3% of the country's total glacier area. Problems arising from a study of the territory are discussed. (Josefson-USGS) W73-14428

DATE OF MAXIMUM ADVANCE OF THE LAST GLACIATION NEAR GRODNO (0 VOZRASTE MAKSIMAL'NOY STADII POSLEDNEGO OLEDENENIYA V RAYONE GRODNO), Geografo-Ekonomicheskii Nauchno-Issledovatel-

Geograto-Exonomicneski naturu, Leningrad, (USSR). Kh. A. Arslanov, L. N. Voznyachuk, F. Yu. Velichkevich, A. I. Zubkov, and Ye. G. Kalechits. Akademiya Nauk SSSR Doklady, Vol 202, No 1, p 155-158, 1972. 1 fig, 1 tab, 10 ref.

Descriptors: \*Glaciation, \*Age, \*Radioactive dating, Carbon radioisotopes, Glacial drift, Glacial

sediments, Silts, Alluvium, Terraces (Geologic), Stratigraphy, Vegetation, Palynology. Identifiers: \*Grodno (USSR).

Determination of the boundary of maximum advance of the Last Glaciation near Grodno in northwestern Belorussia was based on carbon-14 northwestern Belorussia was based on carbon-14 dating of plant remains from submorainal silts in the Laboratory of Geochronology at the Institute of Economic Geography, Leningrad State University. Maximum advance of the Last Glaciation at western borders of the Soviet Union occurred less than 23,000 years ago and, consequently, can be correlated with maximum advance of the Last Glaciation in Western Europe. Siberia and North Glaciation in Western Europe, Siberia, and North America. (Josefson-USGS) W73-14436

MATHEMATICAL ANALYSIS OF A HEAT EXCHANGE THAT CAN BE CONTROLLED BY COMPUTER (ANALYSE MATHEMATIQUE D'UN ECHANGEUR DE CHALEUR QUI CON-VIENT AU CONTROLE PAR ORDINATEUR), National Inst. of Scientific Research, Quebec.

INRS-Eau, Technical Report No 16, 1973, 40 p, 9

Descriptors: "Heat exchangers, "Temperature control, "Temperature, "Control, "Snowmelt, "Refrigeration, "Numerical analysis, Heat transfer, Systems analysis, Conductivity, Attenuation, Thermal conductivity.

Laboratory experiments on melting snow require that the temperature be maintained very accurately at 0C. A device is proposed that adjusts the temperature of the refrigerant by periodic switching of a heater. Because of the cylindrical symmetry, the a meater. Because of the cylindrical symmetry, the periodic component in the heat transferred may be made as small as required, while the mean rate of heating, and thus the final temperature may be controlled by time division. (Cantin-INRS-Eau) W73-14470

SNOW AMOUNT IN RELATION TO STREAM-FLOW AND HERBAGE PRODUCTION IN

WESTERN COLORADO,
Forest Service (USDA), Fort Collins, Colo. Rocky
Mountain Forest and Range Experiment Station. For primary bibliographic entry see Field 03B. W73-14479

COASTAL ICE FORMATION AND ITS EFFECT ON BEACH SEDIMENTATION, Western Michigan Univ., Kalamazoo, Dept. of

Geology. For primary bibliographic entry see Field 02J. For primar W73-14573

MONROES: A TYPE OF SO-CALLED MUD VOLCANOES IN TIDAL FLATS, Centre de Recherches Forestiere des Laurentides, Quebec.

For primary bibliographic entry see Field 02L. W73-14580

OCEANOGRAPHY (OKEANOGRAFIYA). Far Eastern Hydrometeorological Research Inst., Vladivostok (USSR). For primary bibliographic entry see Field 02L. W73-14597

GLACIER PULSATIONS AND PROBLEM OF PREDICTING THEM ON THE MEDVEZHIY GLACIER (PUL'SATSII LEDNIKOV I PROBLEMA IKH PROGNOZIROVANIYA NA PRIMERE LEDNIKA MEDVEZH'YEGO (ZAPADNYY PAMIR)),
Akademiya Nauk SSSR, Moscow. Institut Geografii. L. D. Dolgushin, and G. B. Osipova.

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 2, p 89-98, March-April 1972. 6 fig, 1 tab, 6 ref.

Descriptors: \*Glaciers, Movement, \*Forecasting, Ice, \*Glacial drift, Mountains, Profiles, Surveys. Identifiers: USSR, \*Medvezhiy Glacier, \*Glacier

Investigations were carried out on the Medvezhiy Glacier (Bear Glacier) in the Western Pamirs to study the mechanism of glacier pulsations and the possibility of predicting them. The glacier area is about 25 sq km, and the glacier tongue ranges in size from 4.8 sq km after recession to 6.2 sq km during the period of maximum expansion. Based on systematic observations of the glacier after the 1963 surge, the glacier is expected to advance again in 1974-75. (Josefson-USGS) W73-14600

BASED ON THE EXAMPLE OF THE ZHDANOV PORT AREA (OPYT SPETSIALIZIROVANNOY KHARAKTERISTIKI GIDROLOGICHESKOGO REZHIMA NA PRIMERE RAYONA PORTA ZH-

State Oceanographic Inst., Moscow (USSR). For primary bibliographic entry see Field 04A. W73-14632

PHYSICAL AND THERMAL PROPERTIES OF FROZEN SOIL AND ICE, Continental Oil Co., Ponca City, Okla. For primary bibliographic entry see Field 08D. W73-14717

### 2D. Evaporation and Transpiration

EFFICIENCY OF WATER USE AS IN-FLUENCED BY MICROMETEOROLOGICAL AND PHYSIOLOGICAL PROCESSES, Kansas Water Resources Research Inst., Manhat-ian.

E. T. Kanemasu, I. D. Teare, W. L. Powers, J. W. Sij, and L. J. Brun. Available from the National Technical Informa-

tion Service as PB-223 371, \$3.50 in paper copy, \$1.45 in microfiche. Project Completion Report, Contribution No. 119. July 1973. 68 p, 12 fig, 6 tab, 96 ref. OWRR A-044-KAN (2).

Descriptors: \*Evapotranspiration, \*Photosynthesis, \*Water utilization, \*Sorghum, \*Antitrans-

pirants, Wheat, Stomata. Identifiers: Net photosynthesis, Leaf water potential, \*Stomatal resistance, Open chamber system.

Water-use efficiency (net photosythes-is/evapotranspiration) was studied on sorghum treated with an antitranspirant, pheylmercuric acetate. Short-term studies of 3 to 4 days post-treatment showed that water use efficiency was reduced. Results show that diffusion porometry and field chambers can be used to test other an-titranspiratns applied to field-grown crops. Net photosynthesis and water use efficiency of sorghum was not significantly affected during a period of water stress. Stomatal resistance, as measured with the diffusion porometer, increased measured with the diffusion porometer, increased rapidly at a critical soil moisture and was concurrapinity at a critical soil moistile and was concurrent with a decline in net photosynthesis. Stomatal resistance may be an indicator for irrigation scheduling. Water use efficiency was studied in awned and awnless isogenic lines of wheat. The laboratory study showed that the awnless isogenic head has a 20% greater water use efficiency than the awned. W73-14206

ANTITRANSPIRANTS: A POSSIBLE ALTERNA-TIVE TO THE ERADICATION OF SALTCEDAR

THICKETS, Arizona Univ., Tucson. Dept. of Watershed Management.

For primary bibliographic entry see Field 03B. W73-14226

WATER FLOW IN SOIL IN PRESENCE OF SOYBEAN ROOT SINKS, Minnesota Univ., Minneapolis. Dept. of Soil

For primary bibliographic entry see Field 02G.

PREDICTION OF EVAPORATION FROM HOMOGENEOUS SOIL BASED ON THE FLOW

Agricultural Research Service, Fort Collins, Colo. H. R. Gardner.

Soil Science Society of America Proceedings, Vol 37, No 4, p 513-516, July-August 1973. 3 fig, 3 tab,

Descriptors: "Evaporation, "Soil water move-ment, "Water loss, Diffusivity, Earth-air inter-faces, Equations, Soil moisture, Soil water. Identifiers: Soil water evaporation.

Evaporation of water from columns packed with McGrew loamy sand was measured for three different sequences of six water additions and evaporation times totaling 60 days. These treatments were: (1) equal amounts of water added and count since avaporation (2) about a mounts are likely to the count since a sequence of the count of the counts of th ments were: (1) equal amounts of water added and equal times evaporated, (2) equal amounts applied and varied evaporation times, and (3) various amounts applied and equal evaporation times. The average times and amounts were the same in all treatments, and the total losses were approximate-ly the same. A solution for the diffusivity equation for soils of finite depth was used to predict the cumulative water loss for all the treatments event by event and by an averaging technique. The pre-dicted amounts were all within 6.5% of the total cumulative evaporation. (Knapp-USGS) W73-14421

DIERNAL SOIL-WATER EVAPORATION: CHLORIDE MOVEMENT AND ACCUMULA-TION NEAR THE SOIL SURFACE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

F. S. Nakayama, R. D. Jackson, B. A. Kimball, and R. J. Reginato. Soil Science Society of America Proceedings, Vol 37, No 4, p 509-513, July-August 1973. 9 fig, 10 ref.

Descriptors: \*Evaporation, \*Chemical precipitation, \*Soil water, Soil water movement, Water chemistry, Diurnal, Chlorides, Soil chemistry, Leaching, Mass transfer, Ion transport.

Movement and accumulation of chloride at shal-Movement and accumulation of chloride at shallow depths (0 to 9 cm) were studied in a bare soil following an irrigation. Chloride accumulation in the 0- to 0.5- and 0- to 1-cm depth increments followed a diurnal pattern but out-0f-phase from the soil water content during the first few days after irrigation. The diurnal amplitude of chloride decreased with time as the soil progressively dried. At 1- to 2-cm and deeper depths, diurnal cycling of the chloride content was not measurable, whereas cycling in the water content was evident. Most of the total chloride accumulation at the shallowest depth occurred in the early stages of drying. Howdepth occurred in the early stages of drying. How-ever, chloride movement was detected as low as 4% volumetric water content or approximate 1,000 bars soil water potential. (Knapp-USGS) 73-14422

SOIL-WATER EVAPORATION:

TIME-DEPTH-FLUX PATTERNS,
Agricultural Research Service, Phoenix, Ariz.
Water Conservation Lab. R. D. Jackson, B. A. Kimball, R. J. Reginato, and

F. S. Nakayama. Soil Science Society of America Proceedings, Vol 37, No 4, p 505-509, July-August 1973. 8 fig, 6 ref.

### Group 2D-Evaporation and Transpiration

Descriptors: \*Evaporation, \*Soil water movement, Drying, Air-earth interfaces, Lysimeters, Evaporimeters.

Time-depth patterns of soil water flux in the 0- to 9-cm zone of a bare field soil are described for four 24-hour periods at 3, 7, 16, and 37 days after irrigation. On day 3, the flux at 0 cm (Evaporation) dominated the flux patterns for all depths. As the soil dried, this flux decreased and those at the reater depths gradually became dominant. On all le days of measurement, downward flux was observed below 1 to 3 cm during several hours between sunrise and early afternoon. Only one period of downward flux was observed for day 3, but 2 to 4 periods were noted for subsequent days. These patterns demonstrate the dynamic nature of soil water flux in the surface zone of a field soil subjected to diurnally varying environmental con-ditions. (Knapp-USGS) W73-14423

ECOLOGICAL RESPONSE OF THE AUSTRALIAN NATIVE SPECIES ACACIA HAR-POPHYLLA AND A TRIPLEX NUMMULARIA TO SOIL SALINITY: EFFECTS ON WATER CONTENT, LEAF AREA, AND TRANSPIRA-

Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Cunningham Lab.

For primary bibliographic entry see Field 03C. W73-14472

EFFECT OF SODIUM CHLORIDE SALINITY THE WATER BALANCE OF ATRIPLEX HALIMUS

Hebrew Univ., Jerusalem (Israel). Dept. of Botany.

For primary bibliographic entry see Field 03C.

EFFECT OF CLEARCUTTING A BLACK SPRUCE BOG ON NET RADIATION, Forest Service (USDA), Grand Rapids, Minn. Northern Conifers Lab.

J. M. Brown. J. M. Brown. For Sci. Vol 18 No 4, p 273-277. 1972. Identifiers: Albedo, Black spruce, \*Bogs, Cutting, Energy balance, Evapo transpiration, Picea-Mari-ana, Radiation, \*Spruce, Transpiration, \*Clearcutting, \*Minnesota.

Net radiation measured over a black spruce (Picea mariana) stand and a clearcut strip in a northern Minnesota bog showed little difference in daytime values the first summer after logging. The second summer after logging net radiation was lower in the clearcut strip than over the black spruce stand by 14% in June and 20% in Sept. This difference was due to different surface albedos. Although more energy was potentially available for evapotranspiration in the black spruce stand, more energy was converted into sensible heat than in the clearcut strip .-- Copyright 1973, Biological Ab stracts. Inc.

SEASONAL WATER MOVEMENT IN TREE STEMS, Forest Service (USDA), Corvallis, Oreg. Forestry Sciences Lab

For primary bibliographic entry see Field 02I. W73-14739

### 2E. Streamflow and Runoff

A SELECTED ANNOTATED BIBLIOGRAPHY ON WATER RESOURCES OF THE STATE OF WASHINGTON. Washington State Dept. of Ecology, Olympia.

Available from the National Technical Informa-tion Service as PB-223 350, \$10.50 in paper copy, \$1.45 in microfiche. Water Resources Information System Bulletin No 7, 1973, 548p.

Descriptors: \*Washington, \*Bibliographies, \*Water resources development, Algae, Adminis-tration, Columbia River, \*Radioactivity, Snake River, \*Thermal pollution, Water pollution.

This bibliography, containing 340 abstracts was produced by the Water Resources Scientific Information Center from its information base, comprising SELECTED WATER RESOURCES AB-STRACTS (SWRA). At the time of search for this bibliography, the data base had 50,631 abstracts covering SWRA through December, 1972 (Volume 5, Number 24). Author and subject indexes are in-W73-14201

A SELECTED ANNOTATED BIBLIOGRAPHY ON COLUMBIA AND SNAKE RIVERS. Washington State Dept. of Ecology, Olympia

Available from the National Technical Informa-\$1.45 in microfice. Water Resources Information System Bulletin No 6, 1973, 357 p.

Descriptors: \*Columbia River, \*Snake River, \*Bibliographies, \*Radioactivity, \*Thermal pollution, Streamflow, Water pollution effects, Water pollution sources, Washington, Oregon, Idaho.

This bibliography, containing 238 abstracts, was produced by the Water Resources Scientific Information Center from its information base compris-ing SELECTED WATER RESOURCES AB-STRACTS (SWRA). At the time of search for this bibliography, the data base had 50,631 abstracts covering SWRA through December 1972 (Volume 5, Number 24). Author and subject indexes are in-W73-14202

WATER RESOURCES OF WISCONSIN-LAKE

MICHIGAN BASIN, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-14351

STATUS OF FLOOD-PLAIN MAPPING, GREATER PITTSBURGH REGION, PENNSYL-VANIA, 1972, Geological Survey, Carnegie, Pa. For primary bibliographic entry see Field 07C. W73-14352

HISTORIC AND JUNE 1972 FLOOD ELEVA-TIONS, GREATER PITTSBURGH REGION, PENNSYLVANIA, Geological Survey, Carnegie, Pa. For primary bibliographic entry see Field 07C.

INVESTIGATION OF THE NATURE OF VARIA-TIONS IN ANNUAL RUNOFF COEFFICIENTS IN WEST SIBERIA (ISSLEDOVANIYE PRIRODY KOLEBANIY KOEFFITSIYENTOV GODOVOGO STOKA ZAPADNOY SIBIRI), Institute of Geography of Siberia and the Far East, Irkutsk. (USSR).

Irkutsk. (USSR). V. P. Kulish, I. P. Druzhinin, and S. D. Polisadov. Institut Geografii Sibiri i Dal'nego Vostoka Doklady, No 29, p 34-37, Irkutsk, 1971. 4 fig, 4 ref.

Descriptors: \*Runoff, \*Runoff coefficient, \*Annual, \*Variability, Correlation analysis, Regression analysis, Evaporation, Moisture, Moisture deficit, Maps, Equations.
Identifiers: USSR, \*West Siberia.

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Annual runoff coefficients vary widely in years with low and high runoff. Variation coefficients of annual runoff coefficients were calculated for West Siberia for 1936-60, and a map shows the gradual increase in variation coefficients towards the south (from 0.20 to 0.60). The correlation coefficient of the relation of annual runoff coefficients to total evaporation deficit is 0.86, and correlation coefficients of the relation of annual runoff coeffi cients to total moisture deficit decrease from 0.98 in the north to 0.72 in the south. A gradual decrease in closeness of the relation of runoff coefficients to total moisture deficit and total moisture is observed from north to south. The regression equations obtained can be used for estiations of runoff coefficients in ungaged regions and, in some cases, for forecast purposes. (Josef-W73-14429

HYDROMETEOROLOGICAL INVESTIGA-TIONS IN KAZAKHSTAN (GIDROMETEOROLOGICHESKIYE ISS-LEDOVANIYA V KAZAKHSTANE). Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Alma-Ata

For primary bibliographic entry see Field 02B. W73-14433

LASER DOPPLER VELOCITY MEASURE-MENTS OF SWIRLING FLOWS WITH UP-STREAM INFLUENCE, California Univ., Santa Barbara. For primary bibliographic entry see Field 08B. W73-14571

EXPERIMENTAL STUDY OF LONGSHORE CURRENTS ON A PLANE BEACH, For primary bibliographic entry see Field 08B. W73-14630

WATER WAVES FROM UNDERWATER EX-WATER WAVES FROM UNDERWATER EAPLOSIONS IN SHALLOW WATER, PART II:
CHARACTERISTICS OF WAVES NEAR THE
SHORELINE AND METHOD OF ESTIMATING
WAVE FORCES ON A VERTICAL BARRIER,
Naval Civil Engineering Lab., Port Hueneme,

For primary bibliographic entry see Field 08B. W73-14634

WAVE THEORY AND BREAKER HEIGHT PREDICTION,

Oregon State Univ., Corvallis. School of Oceanog-

In: Proceedings of the 13th Coastal Engineering Conference ASCE, July 10-14, 1972 Vancouver, B.C., Canada, p 405-418, 1972. 6 fig, 17 ref. NOAA SG 2-35187. P. D. Komar, and M. K. Gaughan.

Descriptors: \*Waves (Water), \*Ocean waves, Lake shores, Beaches, \*Coasts. Identifiers: \*Breaker height prediction, Airy wave theory, Solitary waves, \*Near shore processes, \*Wave forecasting

The applicability is examined of linear Airy wave theory to evaluate wave breaker heights. A new relationship is deduced from which the breaker height can be predicted from the deep water wave parameters (wave height and wave period). The theoretical development is set forth and comparison is made with solitary wave theory. The relationship established here is successful over the relationship established here is successful over the entire practical range of wave steepness values. It can also replace the empirical curve given by Munk for the intermediate range of wave slope values. (Sinha-OEIS) W73-14635 RIP CURRENTS. 2. LABORATORY AND FIELD OBSERVATIONS

OBSERVATIONS, Liverpool Univ. (England). Tidal Inst. D. L. Inman. Journal of Geophysical Research Vol 74, No 23, p 5479-5490, October 20, 1969. 9 fig. 4 tab, 11 ref.

Descriptors: \*Rip currents, \*Shallow water, \*Waves (Water), Coasts. Identifiers: \*Near shore processes, Incident waves, Standing edge waves, \*Circulation cells, \*Longshore currents, \*Surf zone, Cusp formation.

The nearshore circulation of water on a plane beach exposed to a uniform wave train, normally incident on the beach, was investigated experimentally in the laboratory. The incident waves generated standing edge waves on the beach of the same frequency as the incoming waves. The in-teraction between these edge waves and the incident waves gave rise to steady flow patterns (nearshore circulation cells) consisting of an onshore flow toward the breakers, a longshore current in the surf zone, and an offshore flow in relatively strong, narrow rip currents. The rip currents were found to occur at alternate antinodes of the edge waves, and the spacing of the rip current was therefore equal to the longshore wavelength of the edge waves. Field observations made in the Gulf of California strongly suggest that this mechanism is important on real beaches. (See also W70-01431) (Sinha-OEIS)

NOTE ON THE KINETIC ENERGY SPECTRUM OF COASTAL WINDS, Oregon State Univ., Corvallis. Dept of Oceanog-

raphy.
For primary bibliographic entry see Field 02B.

W73-14642

PERIODIC MOTIONS OF THE SEASONAL THERMOCLINE ALONG THE SOUTHERN CALIFORNIA COAST, Naval Electronics Lab. Center, San Diego, Calif. J. L. Cairns, and E. C. LaFond.

Journal of Geophysical Research Vol 71, No 16, p. 2002 2015.

3903-3915, August 15, 1966. 12 fig, 11 ref.

Descriptors: \*Thermocline, \*Tides, \*Forecasting, \*California, \*Coasts, Seasonal, \*Winds. Identifiers: Diurnal oscillation, Bathythermographic data, Periodic motions.

An investigation off the southern California coast has shown that a significant part of seasonal thermocline motion is caused by wind transport. A linear relationship for this motion, which takes into account the 14- to 16-hour response time occurring between wind and depth changes, has been established. Through this relationship it is possible to compute and predict movements of the therto compute and predict movements of the ther-mocline caused by the wind. Those found to occur regularly include a diurnal oscillation, an oscilla-tion of 4 1/2-day period, and an over-all upward trend throughout the summer. Tidal thermocline oscillations were studied with the wind effects removed. It was found that during the 4 months of nearly continuous thermocline depth data the internal tide lagged the surface tide by 3 to 5 hours and averaged 4 or 5 times as great in amplitude. (Sinha-OEIS) W73-14646

TSUNAMIS AS GEOLOGICAL AGENTS, Western Australia Univ., Nedlands. Dept. of Geology. P. J. Coleman

Journal of the Geological Society of Australia, Vol 15, Part 2, p 267-273, 1968. 32 ref.

Descriptors: \*Coasts, \*Sediment transport, \*Tsunamis, \*Shallow water, Turbidity currents, Estua-ries, Bays, Bathymetry. Identifiers: Near shore processes. When a tsunami wave series approaches and in-teracts with a coast, the consequent passage shorewards of great volumes of water and their in-vasion of the land, especially within bays and up river valleys, results in the disturbance of existing sediment and the removal seawards of land debris and coastal and shallow-water marine sediments. Tsunami action builds up sequences of peculiar sediments in shallow water; it at least assists in the formation and maintenance of submarine canyons and, through them, produces turbidity currents of a particularly powerful kind. Tsunami action may a particularly powerful kind. Tsunami action may explain many puzzling sedimentary phenomena, for example, sudden and drastic changes in near-shore bathymetry; the formation of chaotic sediments such as some paraconglomerates and edgewise conglomerates. It offers solutions to problems arising from the study of turbiditic sequences, both modern and ancient. (Sinha OEIS) 73-14648

NOTE ON SOME REYNOLDS STRESS EF-FECTS OF INTERNAL WAVES ON SLOPES, Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences. C. Wunsch

Deep-Sea Research Vol 18, p 583-591, 1971. 2 fig, 11 ref. Nonr-1841 (74), Nonr-3963 (31).

Descriptors: \*Coasts, Beaches, \*Mixing, Mathematical models, \*Interal waves, \*Waves (Water). ldentifiers: "Reynolds stress effects, Shoaling beaches, Longshore geostrophic flow, Bermuda, Isopycnals, "Beach slope, Momentum flux, Eu-lerian flow.

When two-dimensional internal waves encounter a shoaling region, the second order mass and momentum flux carried by the waves must be re-adjusted if no mixing occurs. The re-adjustment occurs by a second of the most of the mass of the second of the mass of the second of the mass of curs by a 'set-up' and 'set-down' of the mean isopycnals generating a second order mean Euleri-an flow to cancel the Stokes drift velocity. Since the effects of Coriolis forces in an infinite flat boton a sloping bottom, rotation is easily taken into account, however the problem is degenerate to an arbitrary long-shore geostrophic flow. (Sinha -OEIS) W73-14649

CHANGES IN THE COMPONENTS OF WAVES WHEN REACHING SHALLOW WATER, (IZMENENIYE ELEMENTOV VOLN PRI IKH VYKHODE NA MELKOVOD'YE),

State Oceanographic Inst., Moscow (USSR). I. S. Brovikov.

1.5. BYOYKOV.
Available from the National Technical Informa-tion Service as AD-636 218, \$3.00 in paper copy, \$1.45 in microfiche. Trans. from Trudy Gosudarst-vennogo Okeanograficheskogo Instituta, Vol 50, p 27-32, 8 p, 4 ref, 1960. Naval Oceanographic Of-fice, Washington, DC Report No Trans-235, 1966.

Descriptors: \*Waves (Water), \*Shallow water, \*Beaches, \*Coasts.
Identifiers: \*Near shore processes, \*Wave deformation, Shoaling waves.

The study discusses changes in wave components as they reach shallow water. The friction of water particles against bottom and the irreversible process of the disintegration of waves resulting from the deformation of their shape are considered as the main factors that affect the changes in the components of waves as they reach shallow water. (Sinha - OEIS) water. (Sin W73-14651

EXPERIMENTAL STUDY OF WATERFLOOD

EXPERIMENTAL TRACERS, Jersey Production Research Co., Tulsa, Okla. R. A. Greenkorn. Journal of Petroleum Technology, Vol 14, No 1, p 87-92, January, 1962. 4 fig, 4 tab, 28 ref.

Descriptors: "Flooding, "Injection, "Tracers, Analytical techniques, Chemical analysis, Labora-tory tests, Electrolytes, Fluorescence, Radioac-tivity techniques, Tritium, Sands, Adsorption, Chlorides, Iodides, Nitrates, Bromides, Boron. Identifiers: Dichromate, Thiocyanate, Breakthrough, "Elution curves.

To locate flow paths in a pilot flood, five tracers were needed that could be used together. Thirteen tracers were selected to be tested for grass adsorp-tion on sand and ease and reliability of analysis. Flow tests of brine containing the tracers were made in a sand column containing untreated brine. Breakthrough-elution curves showed that tritiated water, and bromide, chloride, iodide, nitrate and thiocyanate ions met the requirements for ease of analysis and calculation of injected pore volume. analysis and calculation of injected pore volume.

Analytical procedures for each of the thirteen substances examined are given in an appendix. A control chart for duplicate analysis, flow test equipment and procedure and tracer theory are also discussed briefly in appendices. Any contemplated field tracer study should be preceded by laboratory tests at the anticipated flow rates, using the tracers and the porous media to be found in practice. The interpretation of tracer data from resident times of years is doubtful. (Gray-NWWA)

### 2F. Groundwater

MATHEMATICAL MANAGEMENT MODEL OF PARTS OF THE OGALLALA AQUIFER, TEX-

High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
For primary bibliographic entry see Field 04B.
W73-14359

OPTIMAL IDENTIFICATION OF AQUIFER PARAMETERS IN A DISTRIBUTE SYSTEM, California Univ., Los Angeles. Dept. of Engineer-

ing. A. C. Lin. Ph.D. Dessertation, 1973. 88 p, 9 fig, 10 tab, 78 ref. UCAL-WRC-W-290

Descriptors: Aquifers, \*Groundwater, \*Optimization, \*Base flow, \*Aquifer characteristics, \*Distribution systems.
Identifiers: \*Quasilinearization.

The identification of parameters in an unconfined aquifer and stream interaction system is formulated in terms of an optimal control problem. The lated in terms of an optimal control problem. The dynamics of the aquifer head, in general, is governed by a nonlinear partial differential equation of second order. Applying the maximum principle, as well as least-squares optimization, in conjunction with the technique of quasilinearization, aquifer parameters are directly identified based upon observational data at observation stations. The problem of identifying aquifer parameters being considered not only concerns the constant case, but also deals with more complex cases in which the parameters vary with space and/or time. which the parameters vary with space and/or time. (See also W73-14376) (Snyder-California) W73-14375

IDENTIFICATION OF PARAMETERS IN FINITE LEAKY AQUIFER SYSTEM, California Univ., Los Angeles. Dept. of Engineering Systems. M. A. Marino, and W. W-G. Yeh.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 99, No. HY2, p 319-336, 5 fig, 5 tab, 15 ref. UCAL-WRC-W-290.

Descriptors: \*Aquifer characteristics, Aquifers, \*Groundwater, \*Leakage, \*Artesian aquifers, Op-timization, \*Algorithms, Graphical methods, Base Identifiers: Quasilinearization.

### Group 2F-Groundwater

Existing methods for analyzing leaky artesian systems are graphical procedures which involve inflection-point estimation and extrapolation of field data, or superposition and matching, or both, of field data to a family of theoretical curves provided that analytical solutions are attainable. At present, there is no analytical method that treats a leaky artesian system of finite configuration. A systematic procedure for the identification of aquifer parameters in a finite leaky artesian system is developed that converts field observations directly to system parameters. The parameters to be identified are the transmissivity and storativity of the main aquifer and the leakage factor of the system. The algorithm involves finite difference approximation and quasilinearization in conjunction with least-squares optimization. Examples that demonstrate the applicability of the algorithm are presented. (See W73-14375) (Snyder-California) W73-14376

MINERAL AND THERMAL WATERS OF

CANADA, Geological Survey of Canada, Ottawa (Ontario). J. G. Souther, and E. C. Halstead. Canada Geological Survey Paper 73-18, 1973. 32 p, 7 fig, 2 tab, 25 ref, \$1.00. (Reprinted from Proc of 23rd International Geological Congress, Vol 19, p 225-256, Prague, 1969.)

Descriptors: \*Springs, \*Mineral water, \*Thermal springs, \*Canada, Water utilization, Economics, Recreation, Groundwater movement, Geology, Topography, Water yield, Water quality, Ground-water recharge, Water temperature, Chemical analysis, Water analysis.

Identifiers: Hot springs resorts, Health resorts, Therapeutic water

The distribution and character of mineral and thermal waters in Canada are closely related to re-gional topographic and geologic features. Each of the six main physiographic regions is underlain by distinctive rock types and structures that control the circulation of groundwater and hence influence the temperature and quality of water issuing from springs and flowing wells. Most springs including all known thermal springs in Canada occur in the Cordilleran Region where high topo graphic relief permits deep circulation of meteoric water through local and regional flow systems and where relatively high precipitation provides an ample supply of recharge water. Nonthermal springs in other regions of Canada are mainly brine springs. They are commonly associated with Paleozoic marine sedimentary rocks, chiefly limestone, dolomite and shale interbedded with rock salt, gypsum and anhydrite, that overlap the Canadian Shield on the eastern edge of the Interior Plains and occupy sedimentary basins in the Saint Lawrence Lowland and Appalachian regions. A number of thermal springs in western Canada have been developed as recreational and health resorts and water from several nonthermal springs in Quebec is bottled and sold for therapeutic use. Woodard-USGS)

THEORETICAL ANALYSIS OF THE ROLE OF SUBSURFACE FLOW IN THE GENERATION OF SURFACE RUNOFF: 2. UPSTREAM SOURCE AREAS, IBM Watson Research Center, Yorktown Heights,

For primary bibliographic entry see Field 02A. W73-14608

N.Y.

NEW APPROACHES TO WATER-RESOURCES INVESTIGATIONS IN UPSTATE NEW YORK, Geological Survey, Albany, N.Y. A. M. La Sala.

Ground Water, Vol 5, No 4, p 6-11, October, 1967. 9 fig. 3 tab. 3 ref.

Descriptors: Water sources, Water resources, Descriptors: Water sources, water resources, Water analysis, Water quality, Chemical analysis, Streamflow, Runoff, Bank storage, Base flow, Low flow, Gaging stations, Measurement, \*Groundwater recharge, Aquifer characteristics, \*New York, \*Surface-groundwater relationships. Identifiers: \*Dissolved solids content, Lake Erie-Niagara basin, \*Groundwater rating curve

Groundwater in New York State has been intensively studied in large basin investigations, both because of its large potential for future development and because of its interrelation with surface ment and because of its interrelation with surface water resources. The latter reason is particularly important because the principal aquifers are nu-merous unconnected glacial sand and gravel deposits that are crossed by streams. This ground water regimen to a large degree determines the flow characteristics and water quality of streams. Conversely, streamflow data provide a convenient means of assessing ground water availability. The comprehesive program presented here has tried to use surface water data to investigate ground water systems. In this attempt to approach a study of ground water availability and quality by use of stream flow data, the relationship between stream flow quality and ground water discharge is demonstrated. A formula was developed to estimate stream flow quality in relation to quality and quan-tity of ground water discharge. In large-scale and ensive basin investigations such stream studies have also provided a practical means of estimating ground water recharge. (Hunt-NWWA) W73-14709

SELECTED BIBLIOGRAPHY ON LABORATORY AND FIELD METHODS IN GROUND WATER HYDROLOGY, Geological Survey, Washington, D.C. A. I. Johnson.

Geological Survey Water-Supply Paper 1779-Z, 1964, 20 p.

Descriptors: \*Groundwater, Water quality, Mathematics, Physics, Soil mechanics, Soil physics, Geology, Hydraulics, Measurement, \*Bibliographies, \*Reviews, \*Methodology. Identifiers: \*Well construction, Soil moisture equipment.

Presented is a selected bibliography on laboratory and field methods in ground water hydrology and selected areas: mathematics, physics, soil mechanics, soil physics, geology and hydraulics. The selected topics are designed to benefit the young American or foreign national hydrologist by presenting some basic and some advanced reports on methodology, and while not designed to be allinclusive will provide a ready guide to useful source materials. (Hunt-NWWA) W73-14711

FACTORS THAT AFFECT WELL LIFE, Universal Oil Products, St. Paul, Minn. Johnson For primary bibliographic entry see Field 08B. W73-14723

### 2G. Water in Soils

SYSTEMATIC TREATMENT OF INFILTRA-TION WITH APPLICATION, Colorado State Univ., Fort Collins. Dept. of Civil Engineering. H. J. Morel-Seytoux.

Available from the National Technical Informa-tion Service as PB-223 347, \$3.75 in paper copy, \$1.45 in microfiche. Completion Report Series No. 50, Colorado Environmental Resources Center, Fort Collins, June 1973. 64 p, 18 fig, 1 tab, 45 ref. OWRR B-070-COLO (1), 14-31-0001-3566.

Descriptors: \*Infiltration rates, Flow, Compressibility, Numerical methods, Experimental results, \*Soil moisture, Porous media, \*Unsaturated flow, Infiltration, \*Air-water interfaces. Identifiers: \*Two-phase flow, Air viscous effect.

Research has shown that the effects of air movement and air compressibility in soil colums are im-portant. For soils underlain by a relatively impervious layer or by a shallow water table methods based on Richards' equation would overpredict in-filtration rates by factors of 2,3 or more. Even when air compressibility effects are insignificant when air compressionity effects are imaginated as in the case y of an open semi-infinite column, air viscous effects are important. The formula of Green and Ampt underestimates the viscous resistance to flow behind the wetting front from 20 to 70 percent depending on soil type. The use of a theory that considers the movement of water and theory that considers the movement of water and air in the unsaturated zone has the advantage of accountinf for observed experimental results that cannot be modeled by the one-phase flow theory. In addition the mathematical problem is actually simplified, not complicated, by the more complete approach. The fact that the problem of Green Ampt could be solved simply in a few lines whereas it had eluded solution since 1911 is conresults shows that the approximations in the methods of solution yield highly accurate and practical estimates of the infiltration quantities of interest. clusive evidence. Comparison with experimental W73-14205

ORBITAL AND AERIAL (RB-57) PHOTOGRAPHY FOR MAPPING SOILS AND GEOLOGY IN SEMI-ARID WEST TEXAS AND EASTERN NEW MEXICO, Texas Tech Univ., Lubbock. Dept. of

Geosciences For primary bibliographic entry see Field 07C. 73-14328

THE NOAA/NESS PROGRAM OF REMOTE SENSING OF SOIL MOISTURE, National Environmental Satellite Service, National Environmental Satellite Serv Washington, D.C. For primary bibliographic entry see Field 07B. W73-14330

WATER FLOW IN SOIL IN PRESENCE OF SOYBEAN ROOT SINKS, Minnesota Univ., Minneapolis. Dept. of Soil

Available from the National Technical Informa-tion Service as PB-223 505, \$11.00 in paper copy, \$1.45 in microfiche. Minnesota Water Resources Research Center, St. Paul, Bulletin 60, June 1973. 130, pc2 fig, 8 tab, 106 ref. B-015-MINN (7). 14-01-0001-1910.

Descriptors: \*Soil water movement, \*Soybeans \*Evapotranspiration, Crop response, Soil profiles, Irrigation, Hydraulic conductivity, Roots. Identifiers: \*Soil water suction, Suction, Soil water dealstion, Boot Soil Identifiers: \*Soil water s water depletion, Root sinks.

Water depletion patterns in the 10 to 70-cm soil depth in the root zones of two soybean varieties, 79.648 and Chippewa-64, and in a bare soil were established on Waukegan loam. Soil hydraulic properties of the soil profile, suction-water content and hydraulic conductivity-suction relationships were determined in the laboratory and supported by field measurements. Following irrigation, proportional contribution of various soil layers to the total water loss showed a downward shift with the growth state of soybeans. In general, 10-cm layers in the upper horizons constributed in the upper horizons constributed a major portion to the total water losses. The contribution of the 10 to 20-cm layer remained above 20 percent whi that of the 50 to 60-cm layer accounted for less than 10 percent of the total water loss from the 10 to 70-cm profile. During the early stages of growth the evapotranspiration rate was 0.64 cm/day which agrees with the pan evaporation rate of 0.66 cm/day. Soil outside the 10 to 70-cm zone concm/day. Soil outside the 10 to 70-cm zone con-tributed about 0.2 cm/day towards evapotranspira-tion. About 55 percent of the soil volume showed root densitities of 1.0 to 2.0 cm/cm3. Generally, root density tended to be higher near the plant rows and between the 25 and 45-cm depths bellow the surface. (Walton-Minnesota) W73-14367

WEATHERING OF BIOTITE IN SOILS OF A HUMID TROPICAL CLIMATE, Ife Univ. (Nigeria). Dept. of Soils.

A. G. Ojanuga. Soil Science Society of America Proceedings, Vol 37, No 4, p 644-646, July-August 1973. 2 fig, 18 ref.

Descriptors: \*Weathering, \*Clay minerals, \*Soil formation, \*Tropical regions, Kaolinite, Iron, Leaching, Clays.

Weathering of biotite was studied in saprolites derived from granite and gneiss. The soils are in the Southwestern Upland of Nigeria, an area characterized by a humid tropical climate. Kaolinite is the dominant product in the well-derived moderately exist studies. Adolinate is the dominant product in the wein-drained, moderately acidic, tropical soils studied. The formation of kaolinitic pseudomorphs represented a stage in the kaolinization of biotite in the soils. (Knapp-USGS) W73-14412

INFILTRATION, HYDRAULIC CONDUCTIVI-TY, AND RESISTANCE TO WATER-DROP IM-PACT OF CLOD BEDS AS AFFECTED BY CHEMICAL TREATMENT,

Iowa State Univ., Ames. Dept. of Soil Science. For primary bibliographic entry see Field 04D.

RESPONSE OF SALINITY SENSORS TO RAPIDLY CHANGING SALINITY, Agricultural Research Service, Riverside, Calif. Salinity Lab. J. Wesseling, and J. D. Oster.

Soil Science Society of America Proceedings, Vol 37, No 4, p 553-557, July-August 1973. 5 fig, 3 tab,

Descriptors: \*Salinity, \*Electrical conductivity, \*Instrumentation, Calibrations, Water chemistry, Diffusion, Diffusivity. Identifiers: \*Soil salinity meters.

A theory developed to describe the response of the sensor to changes in soil salinity is based on the as sumption that diffusion of solutes into and out of the sensitive element of a salinity sensor determines its response time. This theory was experi-mentally verified in solution and in soils. The response of a sensor is adequately described by a single response factor. Proper use of this factor permits the actual electrical conductivity of the soil solution to be inferred from sensor readings where soil salinity changes rapidly. (Knapp-USGS) W73-14417

A COMPARISON BETWEEN MERCURY IN-JECTION AND NITROGEN SORPTION AS METHODS OF DETERMINING PORE SIZE DISTRIBUTIONS,

Western Australia Univ., Nedlands. Dept. of Soil

Science and Plant Nutrition.
I. D. Sills, L. A. G. Aylmore, and J. P. Quirk.
Soil Science Society of America Proceedings, Vol
37, No 4, p 535-537, July-August 1973. 3 fig, 15 ref.

Descriptors: \*Porosity, \*Soils, \*Soil physical properties, \*Pores, Porous media, Infiltration. Identifiers: Pore geometry, Goethite.

Mercury injection and nitrogen sorption methods of pore size distribution analysis were compared on a sample of goethite using the silt-shaped pore model. Using the commonly accepted contact angle of 140 deg for mercury, the mercury pore-size distribution plot is displaced by approximately size distribution plot is displaced by approximately 20% in plate separation with respect to the introgen plot. The assumption of a contact angle of 153 deg for mercury is required to make the plots coincide. Combination of the two techniques provide a useful method of pore size distribution analysis over a large range of pore sizes. This approach is particularly appropriate to the investigation of the pore structure of soil materials. (Knapp-USGS) W73-14418

USING INFILTRATIONS OF HEPTANE AND WATER INTO SOIL COLUMNS TO DETERMINE SOIL-WATER CONTACT ANGLES, Florida Univ., Gainesville. Dept. of Soil Science. B. Bahrani, R. S. Mansell, and L. C. Hammond. Soil Science Society of America Proceedings, Vol 37, No 4, p 532-534, July-August 1973. 2 fig. 17 ref.

Descriptors: \*Wetting, \*Infiltration, \*Wettability, Porying, Infiltrometers, Soil physical properties, Leaching, Surface tension. Identifiers: \*Heptane, \*Water-repellent soils.

A horizontal infiltration procedure using two liquids, water, and heptane was used for determining wetting soil-water contact angles in columns of water-repellent soil. The method can be used to measure contact angles less than, equal to, or greater than 90 deg and requires minimal reaction time between water and soil during experimental measurements. This technique was applied to two columns of water-repellent Pomello fine sand for six cycles of wetting, leaching, and drying. Wetting contact angles decreased from 101 deg initially to 91 deg after the six cycles. (Knapp-USGS) W73-14419

THEORY OF A RECTANGULAR GRAVEL EN-VELOPE IN DRAINAGE DESIGN, Iowa State Univ., Ames. Dept. of Agronomy. For primary bibliographic entry see Field 04A. W73-14420

PREDICTION OF EVAPORATION FROM HOMOGENEOUS SOIL BASED ON THE FLOW EQUATION,

Agricultural Research Service, Fort Collins, Colo. For primary bibliographic entry see Field 02D. W73-14421

DIERNAL SOIL-WATER EVAPORATION: CHLORIDE MOVEMENT AND ACCUMULA-TION NEAR THE SOIL SURFACE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 02D. W73-14422

DIURNAL SOIL-WATER EVAPORATION: TIME-DEPTH-FLUX PATTERNS, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 02D. W73-14423 SOIL-WATER EVAPORATION:

COINCIDENCE AND INTERFERENCE COR-RECTIONS FOR DUAL-ENERGY GAMMA RAY MEASUREMENTS OF SOIL DENSITY AND WATER CONTENT,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, L. C. Hammond, and R. M.

McCurdy. Soil Science Society of America Proceedings, Vol 37, No 4, p 500-504, July-August 1973. 3 fig, 2 tab, Descriptors: \*Nuclear moisture meters, \*Soil moisture meters, \*Gamma rays, Bulk density, Soil water, Calibrations, Instrumentation. Identifiers: Gamma-ray spectrometers.

Volumetric water content and bulk density changes in a soil column can be simultaneously and rapidly determined from single-detector at-tenuation measurements of a high intensity, dual-energy beam of gamma photons. Coincidence loss due to interference between the two monoener-getic gamma rays and Compton scattering pro-vides gamma photon intensities which are un-desirably interdependent. Correction procedures are given for providing independent determina-tions of both 60 and 662 keV gamma ray intensities. (Knapp-USGS) W73-14424

A MATHEMATICAL INVESTIGATION OF STEADY INFILTRATION FROM LINE SOURCES,

Colorado State Univ., Fort Collins. Dept. of Mathematics.

D. W. Zachmann, and A. W. Thomas. Soil Science Society of America Proceedings, Vol 37, No 4, p 495-500, July-August 1973. 4 fig, 8 ref.

Descriptors: \*Infiltration, \*Soil water movement, \*Subsurface irrigation, Evaporation, Equations, Hydraulic conductivity.

Equations which can be used in the design of subsurface irrigation systems are based on the physics of steady infiltration from a distribution of line sources which lie in a horizontal plane and are parallel and equally spaced. The analytical solu-tion describes the flow from the line sources in the presence of uniform infiltration or evaporation at the soil surface. To increase the utility of the solution, the equations for matric flux potential and stream function are written in dimensionless form. (Knapp-USGS) W73-14425

UNSTEADY TWO-DIMENSIONAL FLOW OF WATER IN UNSATURATED SOILS ABOVE AN IMPERVIOUS BARRIER,

Iowa State Univ., Ames. Dept. of Agronomy H. M. Selim, and D. Kirkham. Soil Science Society of America Proceedings, Vol 37, No 4, p 489-495, July-August 1973. 6 fig, 20 ref.

Descriptors: \*Soil water movement, \*Wetting, \*Unsaturated flow, \*Aquicludes, Unsteady flow, Ditches, Numerical analysis, Drainage systems.

The equation describing unsteady two-dimensional water flow in unsaturated soils may be solved by use of a finite difference approximation and an alternating-direction implicity method. The two-dimensional medium is a homogeneous soil with an impervious barrier at some depth from the soil surface and having equally spaced trenches. The bottoms of the trenches are wetted at time zero and are kept at a constant 0.50 water content. The initial soil water content is 0.20. Water move-ment from the walls of the trenches and the soil surface is neglected. The water content at all loca-tions in the flow medium was obtained for an Ida silt loam soil with two geometries. Near trenches with 120-cm spacing, 30-cm deep, and 30-cm wide, the wetting front reaches a depth of 30 cm in 35 min, and reaches the soil surface in 140 min. Near min, and reaches the soil surface in 140 min. Near trenches with 60-cm spacing, 15-cm deep, and 15-cm wide, the wetting front reaches a depth of 30 cm in 45 min, and reaches the soil surface in 30 min. (Knapp-USGS) W73-14426

CHARACTERISTICS OF THE SOIL MATRIX THAT AFFECT WATER STORAGE AND THAT AFFECT MOVEMENT, Minnesota Univ., Minneapolis. Dept. of Soil

### Group 2G-Water in Soils

Available from the National Technical Information Service as PB-223 539, \$3.00 in paper copy, \$1.45 in microfiche. Minnesota Water Resources Research Center, Minneapolis, Mimeographed Report, August 1973. 34 p, 6 tab, 13 ref. OWRR B-015-MINN (8). 14-01-0001-1916.

Descriptors: \*Soil moisture, \*Soil aggregates, Crops, Water loss, \*Minnesota, Hydraulic con-

ductivity, Cultivation.
Identifiers: "Soil water suction, "Suction-water content, Soil matrix, Soil structure, Thixotropic, Colloidal surface.

Soil that consolidates under influence of water and of machines and animals is usually loosened by tillage. Soil sheared by plows or other tillage implements re-forms with time giving a more water-stable matrix. Soil matric suction increased with time in pulverized, moistened, pressed soil sealed to prevent water loss. Water stability also increased with time for simulated aggregates formed by extrusion under pressure. An interesting field application that increased the soil moisture storage reservoir was established on two sandy soil types where moisture deficiency is the principal yield-limiting factor. Treatment consisted of plowing in a nearly continuous, hot sprayed asphalt barrier 50 cm deep in two replicated experiments. The practical result of this barrier was to increase the plant available water in Zimmerman fine sand from 2.9 cm in the surface 55 cm. In Hubbard loamy coarse sand a sand-gravel layer at 25 to 50 cm itself acted as a barrier to water movement. In the Zimmerman soil it was shown that over a 3-year period supplemental water needed to keep an active growing crop could be reduced by 58% with a barrier. Probable water loss by percolation, on the other hand, would have been less than half as great with a barrier as without. (Walton-Minnesota)

THE RELATIONSHIP BETWEEN SOIL STRUCTURE FACTOR AND BOTH SOLUBLE AND EXCHANGEABLE SODIUM AND CALCIUM IN THE NILE ALLUVIUM OF EGYPT, Cairo Univ., Giza (Egypt). Dept. of Soils. A. Fathi, K. E. Khalil, and S. Milad. United Arab Republic Journal of Soil Science, Vol II, No 2, p 213-232. 1971. 8 fig, 2 tab, 1 map, 7 ref.

Descriptors: \*Soil structure, \*Weathering, \*Cation exchange, \*Alluvium, Deposition (Sediments), Annual flood, Sodium, Calcium. Identifiers: \*Nile Valley (UAR).

Weathering factors on the igneous and metamorphic rock of the Ethiopian plateau compose the soils in much of Egypt's arable lands. They are formed through sedimentation of mud carried by annual floods, and are relatively rich in clay which is greatly affected by soluble exhangeable sodium and calcium cations. The increase in the percentages of soluble and exchangeable calcium increases the soil structure factor, while the increase in both soluble and exchangeable percentages of sodium lowers it. This study was conducted on 2 transects: the first crossing the Nile Delta 30 km north of the Barrage, the second crossing the Nile Valley on the western side of the stream, 12 km south of the Barrage to the borders of the Western Desert. (Bahre-Arizona)

EFFECT OF WASTE WATER FROM THE ASTRAKHAN' CELLULOSE AND PASTEBOARD COMBINE ON SOIL PROPERTIES (VLIVANIVE STOCHNYKH VOD ASTRAKHANSKOGO TSELLYULOZNO-KARTONNOGO KOMBINATA NA SVOYSTVA POCHV), For primary bibliographic entry see Field 05D. W73-14601

STUDY OF SOIL PLATICITY OVER A WIDE RANGE OF MOISTURE CONTENTS (ISS-

LEDOVANIYE PLASTICHNOSTI POCHV V SHIROKOM INTERVALE VLAZHNOSTI), M. B. Minkin, A. G. Kalmykov, and N. I. Ruraychuk.

Pochvovedeniye, No 10, p 121-125, October 1972. 1 fig. 1 tab, 11 ref.

Descriptors: \*Soil physics, \*Plasticity, \*Plasticity index, \*Soil moisture, \*Moisture content, Soil properties, Liquid limits, Viscosity, Dispersion, Humus, Sodium, Chernozems, Chestnut soils, Curves.

Identifiers: USSR \*Rostov Oblast Solonetzes.

Soil plasticity values determined by the cone method of Vasil'yev and the method of Volarovich increase with increasing contents of humus and exchangeable sodium and with increase in degree of disperson. Volarovich's soil plasticity index, which has a strict physical basis, can be used to describe soil physicocomechanical properties over a wide moisture range. Samples of Solonetz, Chestnut, and Chernozem soils from Rostov Oblast were used to show dependence of plasticity on certain soil properties. (Josefson-USGS)

DESCRIPTION OF WATER-SALT RELATIONS OF SOME SOILS IN CENTRAL CISCAUCASIA FROM LYSIMETER EXPERIMENTAL DATA (KHARAKTERISTIKA VODNO-SOLEVOGO REZHIMA NEKOTORYKH POCHY TSENTRAL'NOGO PREDKAVKAZ'YA PO DANNYM LIZIMETRICHESKIKH OPYTOV),

S. P. Sokolovskiy.
Pochvovedeniye, No 10, p 88-98, October 1972. 1 fig. 6 tab. 11 ref.

Descriptors: \*Land reclamation, \*Soils, \*Water balance, \*Salt balance, \*Lysimeters, Soil water, Soil properties, Saline water, Brackish water, Freshwater, Groundwater, Water table, Crops. Identifiers: USSR, \*Ciscaucasia, Mineralization.

Lysimeter investigations in different regions of large irrigation systems in the Central Ciscaucasus are described. Investigations were conducted on calcareous Chernozems, Solonetzic Chernozems, and on Chestnut, Chernozemic, and Alluvial-Meadow soils. Chestnut and Chernozem loam soils are more rapidly salinized by mineralized groundwater (>11-12 g/liter) than clayey soils (Solonetzic Chernozems). Critical groundwater depth for different soils ranged from 0.5 m to 1.8 m, depending on soil hydrophysical properties, soil water and salt relations, groundwater mineralization, and character of land use. Plant suction increases concentration of soil solutions and accelerates soil salinization by mineralized groundwater. (Josefson-USGS)

### 2H. Lakes

ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERABAD-INDIA. III. ZOOPLANKTON AND BACTERIA, Osmania Univ., Hyderabad (India). Hydrobiology

Lab.
For primary bibliographic entry see Field 05C.
W73-14248

NITROGEN AND PHOSPHORUS IN A STRETCH OF THE GUADALUPE RIVER, TEX-AS, WITH FIVE MAIN-STREAM IMPOUNDMENTS,

Southwest Texas State Univ., San Marcos. For primary bibliographic entry see Field 05B. W73-14249 THE LIMNOLOGY OF NITROGEN IN AN OKLAHOMA RESERVOIR: NITROGENASE ACTIVITY AND RELATED LIMNOLOGICAL FACTORS, Oklahoma State Univ., Stillwater. Dept. of Zoolo-

gy. For primary bibliographic entry see Field 05C. W73-14253

THE GENERAL CIRCULATION OF WATER IN LAKE CHAD,
Office de la Recherche Scientifique et Technique
Outre-Mer, Fort-Lamy (Chad),

J. P. Carmouze. Cah ORSTOM Ser Hydrobiol. Vol 5, No 3/4, p 191-212. Illus. 1971. (English Summary). Identifiers: "Chad (Lake Chad), Circulation, Lakes, "Sodium.

The Na content of the river waters varies according to the time they spent in the lake. It is possible by this relation to trace the general movements of the lake waters by observation of the distribution in time and space of the Na concentration. The modifications caused by the variations of other saltness factors are considered. The hydrodynamic factors are analyzed in order to explain annual water movements.— Copyright 1973, Biological Abstracts, Inc. W73-14279

SOURCES AND SINKS OF NITROGEN AND PHOSPHORUS: WATER QUALITY MANAGE-MENT OF LAKE GEORGE (N.Y), Rensselaer Polytechnic Inst., Troy, N.Y. For primary bibliographic entry see Field 05B. W73-14284

PHYSICO-CHEMICAL ASPECTS OF LAKE MCILWAINE (RHODESIA), A EUTROPHIC TROPICAL IMPOUNDMENT, Rhodesia Univ., Salisbury. Div. of Biological Sciences.

For primary bibliographic entry see Field 05C. W73-14291

WATER RESOURCES OF WISCONSIN-LAKE

MICHIGAN BASIN, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-14351

DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO, Geological Survey, Arlington, Va. For primary bibliographic entry see Field 07B. W73-14354

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geosciences.
For primary bibliographic entry see Field 07B.
W73-14336

ALGAL PHOTOSYNTHESIS, ALGAL ABUNDANCE, AND CHEMISTRY OF LAKE WATER AT FAIRMONT, MINNESOTA, Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 05C. W73-14364

EFFECT OF SILT AND SILT REMOVAL IN A PRAIRIE LAKE, Dakota State Coll., Madison, S. Dak. Dept. Biology; and Dakota State Coll., Madison, S. Dak. Dept. of Chemistry. For primary bibliographic entry see Field 05C. W73-14373 EFFECTS OF ARTIFICIAL DESTRATIFICA-TION ON PRIMARY PRODUCTION AND ZOOBENTHOS OF EL CAPITAN RESERVOIR,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife. For primary bibliographic entry see Field 05C. W73-14448

DETRITUS IN LAKE TAHOE: STRUCTURAL MODIFICATION ATTACHED MUCROFLORA, California Univ., Davis. Inst. of Ecology. For primary bibliographic entry see Field 05C. W73-14445

REPORT ON HALF MOON LAKE. Half Moon Lake Restoration Committee, Eau Claire, Wis. For primary bibliographic entry see Field 05G. W73-1494

LABORATORY STUDY OF SEICHING IN-DUCED ON AN OFFSHORE SHELF, Naval Civil Engineering Lab., Port Hueneme, For primary bibliographic entry see Field 08B. W73-14627

SOME THREE-DIMENSIONAL EFFECTS IN SURF, Wisconsin Univ., Madison.

Wiscousin Only, Madison R. E. Meyer, and R. B. Turner. Journal of Geophysical Research, Vol 72, No 10, p 2513-2518, May 15, 1967. 1 fig, 7 ref, 1 append. Nonr 562 (34), Nonr 1202 (27).

Descriptors: \*Surf, \*Beaches, \*Waves (Water), Shallow water, Hydrodynamics, Coasts, Ocean Identifiers: \*Beach geometry, Swell, Near shore

The asymptotic equations of surf are derived for shallow beaches with a geometry causing long-shore variations in the water motion. Such surf is generally governed by three-dimensional nonlin shallow-water equations. When the seabed profile parallel to shore is of gentler slope than the profile normal to shore, however, the asymptotic equa-tions are shown to differ only in minor respects from those of two-dimensional surf. Such 'weakly ntree-dimensional' surf can be analyzed directly in terms of the results of the two-dimensional theory, and the run-up bounds of that theory are extended accordingly. (Sinha-OEIS) W73-14662

PLAN GEOMETRY OF HEADLAND-BAY

BEACHES, Virginia Polytechnic Inst., Blacksburg. Dept. of Geological Science. W. E. Yasso.

W. E. 1 assu. Journal of Geology, Vol 73, No 5, p 702-714, September 1965. 6 fig. 8 ref.

Descriptors: \*Beaches, \*Sediment transport, Sedimentation, \*Waves (Water), Coasts.
Identifiers: \*Headland-bay beaches, Near shore processes, Geometry, Wave refraction, Wave train diffraction, \*Coastal geomorphology.

A 'headland-bay' beach is defined as a beach lying in the lee of a headland subjected to a predominant direction of wave attack. Such beaches characteristically have a seaward-concave plan shape resulting from erosion caused by refraction, difresuning from erosion caused by refraction, dif-fraction, and reflection of waves into the shadow zone behind the headland. Tide-induced currents have no direct effect on the plan shape of headland-bay beaches. Increasing radius of plan curvature with distance from the headland sug-gested testing the logarithmic spiral, r ± e theta cot

alpha, as an approximation to the shape of headland-bay beaches. Four natural beaches were headland-bay beaches. Four natural beaches were selected for testing goodness of fit to the log-spiral approximation: Spiral Beach, Sandy Hook, New Jersey; Halfmoon Bay Beach, California; Drakes Beach and Limantour Spit Beach lying along the Drakes Bay shoreline to the north of San Francisco, California. Published maps were used as a source of data on shoreline shape except for Spiral Beach which was mapped by the writer using enjener's transit in a longitudinal survey technique. An IBM 7090 computer was programmed to generate a best fitting log-spiral to each shoreline curve. Results ranged from excellent to good with the best fit being to Spiral Beach curvature, for which mean squared error in length of the logwhich mean squared error in length of the log-spiral radius vector was only 0.82 feet squared. Constant spiral angle, a, ranged between 41.26 deg and 85.64 deg. Centers for three of the best fitting log-spirals lay in close proximity to the shoreward portion of each headland. (Sinha-OEIS) W73-14663

EFFECT OF PARTICLE SIZE AND DISTRIBU-TION ON STABILITY OF ARTIFICIALLY FILLED BEACH PRESOUE ISLE PENINSULA

PENNSYLVANIA,
Army Coastal Engineering Research Center,
Washington, D.C.
For primary bibliographic entry see Field 02J.
W73-14664

FOOD HABITS OF THE COHO SALMON, ON-CORHYNCHUS KISUTCH,

MICHIGAN, Wisconsin Univ., Milwaukee. Dept. of Zoology. M. A. Harrey, and C. R. Norden. Trans Wis Acad Sci Arts Lett, 60, p 79-85, 1972, Il-

Identifiers: \*Coho salmon, \*Food habits, Insects, \*Lake Michigan, Oncorhynchus-kisutch, Salmon, Smelt, Stickleback.

The stomach contents of 36 coho salmon, O. kisutch, taken from southern Lake Michigan were examined. The contents were identified and nuexamined. The contents were identified and in-merical and volumetric methods were used to analyze the data. The results indicated that the coho salmon in Lake Michigan is primarily piscivorous. Fish comprised 96.9% by volume of the coho's diet and the alewife accounted for 62% of the total stomach contents. Other items in-cluded in the coho's diet were smelt, stickleback and insects.--Copyright 1973, Biological Ab-

### 2I. Water in Plants

FINAL REPORT ON DRIFT STATION BIOLOGY: ZOOPLANKTON TAXONOMY AND SORT-ING PROGRAMS, University of Southern California, Los Angeles. Dept. of Biological Sciences. H. R. Fernandez.

n. s., Fernandez. Available from the National Technical Informa-tion Service as AD-756 661. January 1973. 45 p. 13 tab, 10 ref. Project No. NR 307-270. Contract No. N00014-67-A-0269-0013.

Descriptors: "Zooplankton, "Systematics, "Classification, "Ecological distribution, "Arctic Ocean, Crustaceans, Invertebrates, Sampling, Aneilds, Mollusks, Marine animals, Animal groupings, Arctic, Copepods, Spatial distribution, Methodology, Jelly fish, Amphipoda, Gastropods, Life cycles, Animal growth, Isopods. Identifiers: "Taxonomic guides, Vertical distribution, Sample preservation, Chaetognaths, Tunicates, Nemerteans, Macroinvertebrates, Ctenophora, Coelenterates, Calanoida, Sample preparation, Appendicularians, Polychaetes,

preparation, Appendicularians, Polychaetes, Hydrozoans, Scyphozoans, Siphonophores,

Pteropods, Pelgobia longicirrata, Spiratella nelicina, Lucioutia polaris, Lucicutia anomala, Pteropods, Lucicutia pseudopolaris, Ostracods, Conchoecia borealis maxima, Conchoecia elegans, Conchoecia skogsbergi, Conchoecia rotunda, Bathyconchoecia, Acetabulastoma arcticum, Gammarus wilkitzkii, Gammaracanthus loricatus, Calanus hyperboreus, Decapods, Euphausiids,

The taxonomic studies of Arctic zooplankton conducted as part of the activities of the USC Arctic Project are summarized. The purposes of such stu-dies were to (1) identify the marine fauna of the area; (2) produce taxonomic guides which would enable biologists to readily identify Arctic zooplankton; and (3) study the biology of some of the organisms, to form the basis for biochemical and physiological investigations. A list is included of the stations and the organisms identified. (Holoman-Battelle) W73-14312

SOME ROTIFERS FROM CAMBODIA,

Lund Univ. (Sweden). Limnological Inst. B. Berzins. Hydrobiologia, Vol 41, No 4, p 453-459, May 30, 1973. 12 fig., 10 ref.

Descriptors: \*Rotifers, \*Aquatic animals, \*Speciation, Invertebrates, Classification, Syste-

Identifiers: \*Cambodia, Filina camasecla can bodgensis, Lecane blachei, Anchitestudinella mekogensis, Branchionus donneri, Animal morphology.

Some species of rotifers from Cambodia are described. (Holoman-Battelle) W73-14313

THE TESTACEA IN THE AREA OF BUSCHEL-BACH STATION (BIEBER/SPESSART, GER-MANY), (DIE TESTACEEN IN DER UM-GEBUNG DER STATION BUSCHELBACH (SPESSART/BRD)), Salzburg Univ. (Austria). Lunz Biological Station.

H. Laminger. Hydrobiologia, Vol 41, No 4, p 501-513, May 30,

Descriptors: \*Ecology, \*Systematics, \*Protozoa, Dominant organisms, Sediments, Springs, Mosses, Water, Biological communities, Sampling, Aquatic animals, Invertebrates, Specia-

Identifiers: \*Testacea, Arcella spp, Centropyxis spp, Trigonopyxis arcula, Difflugia spp, Pontigula-sia spp, Heleopera spp, Hyalosphenia papilio, Lesquereusia spiralis, Nebela spp, Quadrulella spp, Assulina spp, Corythion spp, Euglypha spp, Placocista spinosa, Sphenoderia Tracheleuglypha dentata, Trinema spp, Phryganella acropodia, Cyphoderia spp, Cryp-todifflugia spp, Difflugiella sacculus, \*Germany.

Taxonomy and ecology of Testacea in samples laxohomy and econgy or resuccion from Sphagnum and from sediments of a pool, some springs and small waters collected near Buschelbach (Bieber/Spessart, Germany) were studied. Eighty-nine species were found. The studied. Eighty-nine species were found. The Euglyphidae, one of the 9 investigated families, dominated with Trinema (T. lineare, T. enchelys), Corythion (C. dubium), Assulina (A. muscorum), Euglypha (E. rotunda, E. laevis, E. cristata) and enoderia (S. minuta). The Nebelidae, another of the 9 families, were also relatively frequent, especially Nebela (N. collaris-bohemica-tinctaespecially Neocia (N. couaris-bonemica-tincta-group), Lesquereusia (L. spiralis) and Quadrulla (Qu. symmetrica). Specimens of the families Ar-cellidae, Centropyxidae and Diffugiidae were generally more rare. (Little-Battelle) W73-14314

### Group 21-Water in Plants

VEGETATION-TERRAIN FEATURE RELA-TIONSHIPS IN SOUTHEAST ARIZONA,
Oregon State Univ., Corvallis. Rangeland Resources Program.
For primary bibliographic entry see Field 07B.
W73-14336

COMPARATIVE EVALUATION OF THERMAL PROFILE DATA OF HEALTHY AND INFESTED ENGLEMANN SPRUCE,
Forest Service (USDA), Phoenix, Ariz. Bureau of For primary bibliographic entry see Field 07B. W73-14337

ENERGY BUDGET AND PHOTOSYNTHESIS OF CANOPY LEAVES, California Univ., Los Angeles. Dept. of Geog. W. H. Terjung, and S. S-F. Louie.

Annals of the Association of American Geog-raphers Vol 63, No 1, p 109-130, March 1973. OWRR B-100-CAL (3) and B-121-CAL (3). 14-31-0001-3061 and 14-31-0001-3260 Amended.

Descriptors: Distribution patterns, \*Photosynthesis, \*Energy budget, Temperature, \*Leaves, Canopy, \*Radiation, Model studies.

The relation between leaves (broad and needle leaves) in a canopy and parts of the soil-atmosphere environment is modeled and analyzed. The parameters examined are concerned with The parameters examined are concerned with short and longwave radiation, reradiation, and latent and convectional heat fluxes at the leaf level. The resulting leaf energy budget is empirically linked to a generalized model of potential photosynthesis whose major inputs are solar radiations of the tion and leaf temperature. The predictions of the tion and leat temperature. The predictions of the combined process-response system do not attempt to portray existing plants, but are used to infer the trend of the major forcing and response funtions of leaves in general when exposed to a great variety of environmental conditions. Leaves in the topmost canopy exhibit the highest Bowen ratios and highest potential photosynthesis, whereas the opposite is the rule among interior leaves. During the growing season many middle latitude climates how higher potential productivity than moist show higher potential productivity than moist, tropical climates.

W73-14358

HYDROLOGIC REGIME OF CONIFEROUS BROAD-LEAVED FOREST TREES IN THE SOUTHERN MARITIME TERRITORY (GIDROLOGICHESKIY REZHIM KHVOYNO-SHIROKOLISTVENNYKH LESOV YUZH-NOGO PRIMOR'YA),
Akademiya Nauk SSSR, Vladivostok. Institut

Biologii. V. I. Tarankov.

Izdatel'stvo 'Nauka', Leningrad, 1970. 120 p.

Descriptors: \*Hydrologic cycle, \*Water balance, \*Mountain forests, \*Coniferous forests, \*Coniferous trees, Pine trees, Fir trees, Ash trees, "Conterous trees, rine trees, ril trees, Ast Ires, Precipitation (Atmospheric), Surface runoff, Sub-surface runoff, Evaporation, Transpiration, Soil water, Infiliration, Snow cover, Water equivalent, Water storage, Retention, Conservation. Identifiers: "Maritime Territory (USSR), Pluvio-grams, Chronoisopleths, Topoisopleths.

Long-term (1959-65) investigations Long-term (1959-65) investigations of the hydrologic regime of mountain pine, fir, and ash forest trees in the Suputinka nature preserve, occupying about 17,000 hectares in the southern part of the Maritime Territory, have shown that forest plantings have an effect on major items in the water balance. Items examined include precipitation, soil water, surface and subsurface runoff, evaporation from soil surfaces and grass cover, transpiration of tree stands, and total evaporation. transpiration of tree stands, and total evaporation. To improve moisture supply and increase water yield, pine and fir trees on mountain slopes of less

than 15 deg steepness should be thinned to a densi-

THE EFFECT OF GRADUAL LEACHING ON THE GROWTH AND YIELD OF SUGAR CANE
IN SALINE SOILS,
For primary bibliographic entry see Field 03C.

SOME FACTORS INFLUENCING TOLERANCE TO MOISTURE STRESS OF THREE RANGE Idaho Univ., Moscow. Forest, Wildlife and Range Experiment Station. For primary bibliographic entry see Field 04A. W73-14475

WESTERN WHEATGRASS GERMINATION AS RELATED TO TEMPERATURE, LIGHT, AND MOISTURE STRESS Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment For primary bibliographic entry see Field 04A. W73-14481

COMPOSITION CHEMICAL OF SOUTHERN GREAT PLAINS GRASSES AS RE-LATED TO SEASON AND PRECIPITATION, Texas Tech Univ., Lubbock. Dept. of Range and

Wildlife Management.
For primary bibliographic entry see Field 04A. W73-14482

STRESS METABOLISM. II: CHANGES IN PROLINE CONCENTRATION IN EXCISED PLANT TISSUES, Waite Agricultural Research Inst., Glen Osmond

(Australia). Dept. of Plant Physiology. For primary bibliographic entry see Field 03F. W73-14503

STRESS METABOLISM. IV: THE INFLUENCE OF (2-CHLOROETHYL) TRIMETHYLAM-MONIUM CHLORIDE AND GIBBERELLIC ACID ON THE GROWTH AND PROLINE AC-CUMULATION OF WHEAT PLANTS DURING WATER STRESS

Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Plant Physiology. For primary bibliographic entry see Field 03F. W73-14505

STRESS METABOLISM. III: VARIATIONS IN RESPONSE TO WATER DEFICIT IN THE BAR-

RESPONSE TO WATER DEFICIT IN THE BAK-LEY PLANT,
Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Plant Physiology.
For primary bibliographic entry see Field 03F.
W73-14506

EXTENT TO WHICH THE TECHNIQUE EM-PLOYED FOR THE BUILDING OF THE LIP-TOVSKA MARA DAM HAS INFLUENCED OR-NITHOCENOSES, (IN CZECH), Komenskeho Universita, Bratislava Komenskeho Universita, Bratislava (C-zechoslovakia). Z. Feriancova-Masarova, and O. Ferianc. Biologia (Bratisl), Vol 27, No 2, p 141-146. 1972.

(English summary).

Identifiers: Anthropophilous, Biotypes, Birds, \*C-zechoslovakia (Liptovska Mara Dam), Dams, Meadows, \*Ornithocenoses, Woods, \*Biotopes.

Dam building brings about the development of new water biotopes with consequent changes in the original ornithocenoses. Gradual changes in bird synusiae could be seen while dam construc-

tion was still in progress, as evidenced by studies of those parts of the Liptov Basin (C-zechoslovakia) that were to be submerged and form the Liptovska Mara. Two biotopes were partorm the Liptovska Mara. I wo blotopes were par-ticularly affected by the dam construction (original wet meadows and the course of the Vah river. In the ornithocenoses of the vegetation covering the shores of the reservoir and of smaller woods, there was a decrease both in the number of species and was a decrease both in the number of species and of individuals of some species and a change in the composition of the bird communities by species. The field biotope was affected only in the building site itself. Some species of anthropophilous birds disappeared.—Copyright 1973, Biological Abstracts, Inc. W73-14542

STOMATAL RESISTANCE DURING SENESCENCE OF HARDWOOD LEAVES, New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources. G. W. Gee, and C. A. Federer. Water Resources Research, Vol 8, No 6, p 1456-1460, December 1972. 2 fig, 12 ref. OWRR A-025-NH (1)

Descriptors: \*Leaves, \*Stomata, \*Moisture deficit, \*Hardwood, \*New Hampshire, Againg (Biological), Precipitation, Plant physiology, Surveys, Methodology, Chlorophyll, Seasonal, Diurnal, Moisture content, Diffusion, Transpiration. Identifiers: Leaf color changes.

Leaf resistance to vapor flow was measured with a diffusion porometer on hardwood trees in central New Hampshire during autumn senescence and was compared with leaf color and chlorophyll con-tent. Daytime diffusion resistance remained at the low values found in summer (1-10 sec/cm) as long as the leaves remained green. Resistances ranged from 5 to >35 sec/cm when chlorophyll content was below 0.4 mg/g of fresh weight and leaf color was yellow green or yellow. Autumn transpiration evidently continues unabated in green leaves but declines to small values when leaves turn color. (Woodard-USGS) W73-14543

AN ANNOTATED LIST OF FISHES FROM THE AN ANNOTATED LIST OF FISHES FROM THE UPPER SALT RIVER, KENTUCKY, Louisville Univ., Ky. Dept. of Biology; and Louisville Univ., Ky. Water Resources Lab. R. D. Hoyt, S. E. Neff, and L. A. Krumholz. Kentucky Academy of Science Transactions, Vol. 1012 (1997) 31, No 3-4, p 51-63, 1970. 3 fig, 12 ref. OWRR B-005-KY (4).

Descriptors: \*Fish populations, \*Fish taxonomy, \*Fish types, \*Pre-impoundment, \*Kentucky, Reservoir sites, Baseline studies, Rivers, Streams, Wildlife management, Classification, Flood control, Reservoirs, Ecology, Environmental effects. Identifiers: \*Upper Salt River (Ky).

Three flood control impoundments are scheduled for construction on the Salt River and its two tributaries in Kentucky during the 1970's. Since the impoundment of the river will create three the impoundment of the river will create three sizable bodies of water (4000 acres each) and will cause changes in the flora and fauna and influence downstream water quality, an intensive preimpoundment survey of the Salt River has been undertaken. Information gathered in this survey will permit an accurate appraisal of the various changes that will be brought about by impoundment of portions of the river system. This analysted list describes the relative abundance and notated list describes the relative abundance and distribution of fishes in the upper Salt River in order to correlate preimpoundment conditions with later postimpoundment conditions. The 5 predominant species in the area in order of abundance were Lepomis megalotis, Pimephales notatus, Notropis ardens, Lepomis cyanellus, and Campostoma anomalum. (Woodard-USGS) W73-14544 ORIGINS AND ECOLOGY OF THE SIERRAN ALPINE FLORA AND VEGETATION, New Hampshire Univ., Durham. Dept. of Botany. For primary bibliographic entry see Field 04A. W73-14545

THE BIOMASS, PRODUCTIVITY, AND PHYTOGEOCHEMISTRY OF THE VEGETATION OF THE BANKS OF A STREAM IN ARDENNE (THE GEMBES STREAM AT DAVERDISSE, LUXEMBOURGIAN PART OF THE ARDENNE REGION): II. PHYTOGEOCHEMICAL SURVEY, (IN FRENCH). FRENCH), Univ.

(Belgium). Laboratoire de Botanique Systematique et d'Ecologie. S. Denaeyer-De Smet.

Bull Soc R Bot Belg. Vol 103, No 2, p 383-396.

Bull 30c R Both Both 1970. (English summary). Identifiers: \*Phytogeochemical surveys, Alluvial vegatation, Banks, \*Biomass, Chlorides, Fertility, Foliar, Geochemistry, Potassium, \*Productivity, Silicon, Sodium, Soils, Streams, Surveys, Silicon, Sodium, So \*Vegetation, \*Belgium.

A preliminary phytogeochemical study, based on polyelements and Na, C1, and Si foliar analysis, was made on the riverine vegetation of the Gembes stream. Alluvial vegetation differs from more typical terrestrial vegetation by a generalized N richness and a nearly as general K poorness. Several phytochemical groups have been distinguished. High N content of the alluvial soils studied and good nitrification conditions probably account for high N level in the plants. The very coarse texture and K poorness of the soils may be considered as responsible for the very bad K plant nutrition--Copyright 1973, Biological Abstracts, Inc. W73-14596

THE NATURAL VEGETATION OF THE SOUTHEAST SPANISH DRY AREA, Goettingen Univ. (West Germany). Systematisch-Geobotanisches Institut. For primary bibliographic entry see Field 04A.

EFFECTS OF WATER STRESS, GIBBERELLIC ACID AND 2-CHLOROETHYLTRIMETHYLAMMONIUMCHLORIDE (CCC) ON FLOWER DIFFERENTIATION IN 'EUREKA' LEMON

TREES, Hebrew Univ., Rehovoth (Israel). Dept. of Agricultural Botany. I. Nir, R. Goren, and B. Leshem.

J Am Soc Hortic Sci. Vol 97, No 6, p 774-778.

1972. Illus.

Identifiers: Anatomy, \*Chlorides, Flowers, Gibberellic-Acid, Growth, \*Lemon trees, Morphology, Trees, \*Water stress.

Attempts were made to identify the stage of flower differentiation of subterminal buds under water stress conditions. Anatomical and morphological studies established that flower differentiation occurs during the stress period and that the genera-tive bud formed does not undergo flower develop-ment until water is supplied. Gibberellic acid (GA) applied under normal irrigation conditions in-hibited summer flower formation even when supplied after the first stages of flower bud dif-ferentiation, and stimulated vegetative growth of either 1 or 2 dormant axillary meristems. In con-2-chloroethyltrimethylammoniumchloride induced flower formation when applied by the end of Aug. to irrigated trees. Treatments with GA water stress conditions prevented flower formation but were inactive when applied after the renewal of irrigation and beginning of anthesis.— Copyright 1973, Biological Abstract, Inc. W73-14737

GERMINATION STUDIES ON SOME ANNUAL SPECIES FROM AN ARID REGION OF WESTERN AUSTRALIA, Western Australia Univ., Nedlands. Dept. of

Botany. J. J. Mott.

J Ecol. Vol 60, No 2, p 293-304. 1972. Illus JECOL. Vol 60, no. 2, p. 29-394. 1972. Inus. Identifiers: Annual species, Arid land, Aristida-contorta, "Australia (Murchison region), "Germination (Annualplants), Grasses, Helichrysum-cassinianum, Helipterum-craspedioides, Rain, Seasonal, Temperature.

Assessments of numbers of annual plants in the arid Murchison Region showed a marked seasonal variation in floral composition. Summer rain variation in floral composition. Summer rain produced a predominance of grasses, while winter rains resulted mainly in the growth of dictyledons. Incubation of topsoil under warm conditions yielded flora of a summer type, while cooler conditions resulted in germination of typical winter vegetation. Determination of the germination characteristics of Aristida contorta, Helipterum craspedioides and Helichrysum cassinianum, indicates that the control of seasonal germination way he at first due to corrected of the vacuus seed. may be at first due to dormancy of the young seed may be at 11st due to dormancy of the young seed of each species, and subsequently to temperature requirements. Germination of these species may be controlled by the necessity of the surface seed to remain moist for some time before germination so that a heavy rain is required for germination and establishment.—Copyright 1973, Biological Abstracts Lieux stracts, Inc. W73-14738

SEASONAL WATER MOVEMENT IN TREE

STEMS, Forest Service (USDA), Corvallis, Oreg. Forestry Sciences Lab. P. W. Owston, J. L. Smith, and H. G. Halverson.

For Sci. Vol 18, No 4, p 266-272. 1972. Illus. Identifiers: Abies-magnifica, Forests Phosphorus-32, \*Pinus-contorta, Seasonal, Transpiration, \*Tree stems, Water movement, \*California, \*Fir.

Water movement in boles of 60-yr-old lodgepole pine (Pinus contorta Dougl.) and red fir (Abies magnifica A. Murr.) in the Sierra Nevada of California was estimated by monitoring the ascent of 32p injected into small roots. Daytime rates of ascent for both species was 12-84 cm/hr in summer. No movement occurred in lodgepole pine during winter. Winter rates for red fir averaged 0.4-1.4 cm/hr. In Oct., volume of daytime water movement was estimated to be 1.3-5.3 1/hr in boles of individual trees. The technique may be used to estimate transpiration from a forest area. Expanding the volume of water transport to a hypothetical hectare of forest gave a transpiration rate of 0.16 cm/day in Oct.—Copyright 1973, Biological Abstracts, Inc.

PREDICTION OF SITE INDEX OF LODGEPOLE PINE FROM SELECTED ENVIRONMENTAL FACTORS,
Colorado State Univ., Fort Collins. Dept. of Forest Science. E. W. Mogren, and K. P. Dolph. For Sci. Vol 18, No 4, p 314-316. 1972. Por Sci. Vol. 16, No. 4, p. 514-316. 1972. Identifiers: Annual, Environmental factors, Moisture, Particle size, \*Pine (Lodgepole), Pinus-contorta, Precipitation, Prediction, \*Site index, Soils, Solum, Stoniness, \*Colorado, \*Wyoming.

Site index and selected soil, climatic, and topographic characteristics were recorded for 72 1/4 acre plots in well-stocked, even-aged lodgepole pine (Pinus contorta Dougl.) stands in north-cen-tral Colorado and south-central Wyoming. Within the range of the area examined, site index can be estimated using 4 environmental variables: percent of soil particles larger than 0.25 mm in diameter in the A horizon; total solum depth in inches; esti-

mated percent of surface stoniness; and average annual percent or surface stonness; and average annual percipitation in inches. The prediction equation derived from multiple regression analysis accounted for 78% of the variance in site index, with most variation (58%) due to particle size.--Copyright 1973, Biological Abstracts, Inc. W73-14740

FOOD AVAILABILITY AND CONSUMPTION BY YOUNG CONNECTICUT RIVER SHAD ALOSA SAPIDISSIMA, Holyoke Community Coll., Mass. Dept. of Biolo-

gy. R. C. Levesque, and R. J. Reed. J Fish Res Board Can, Vol 29, No 10, p 1495-1499, 1972. Illus.

Identifiers: Alosa-sapidissima, \*Connecticut River, Crustaceans, Food habits (Fish), Insects, Larvae, Rivers, \*Shad, Tendipedid, Trichoptera.

Food habits of young A. sapidissima were studied in the Connecticut River above Holyoke, Mas-sachusetts in 1969. Diurnal feeding data revealed a peak in stomach content volume at 8:00 PM during midsummer. Larval shad fed mainly on aquatic crustaceans and tendipedid larvae and pupae. Ju-veniles ingested the most abundant organisms: crustaceans, tendipedid larvae and pupae, hydropsychid larvae and adult insects. Electivity hydropsychid larvae and adult insects. Electivity data indicated positive selection for tendipedid pupae and crustaceans and negative selection for hydropsychid larvae and tendipedid larvae. Selection of Trichoptera larvae by young shad in significant amounts was documented.—Copyright 1973, Biological Abstracts, Inc. W73-14743

AERATION AND SITKA SPRUCE SEEDLING GROWTH IN PEAT, Northern Forest Research Center, Edmonton (Al-

berta).

J Ecol, Vol 60, No 2, p 343-349, 1972, Illus. Identifiers: Diffusion, Growth, Oxygen, \*Peat, Picea-sitchensis, Seedlings, Sitka spruce, \*Soil aeration, \*Spruce, Sulfides.

A 30 deg slope was created in deep peat in situ and extended up from the water-table at 91 cm depth to 46 cm above ground surface level. Rows of 8-wkold Sitka spruce (Picea sitchensis (Bong.) Carr.) seedlings in plastic tube containers were planted along the gradient from 0-137 cm above water-level. At 5-7 weekly intervals, during a 4-mo. growing season, soil aeration was assessed along the slope by means of a polarographic technique to determine oxygen diffusion rates (O.D.R.). A soil aeration gradient was sustained throughout the season from the water-level to the top of the slope. Seedling height growth and oven-dry weights measured at the end of the growing period closely followed the soil aeration gradient. Sulfide concenlowed the soil aeration gradient. Sulfide concentrations at the poorly aerated lower end of the slope may have contributed to mortality among seedlings there. Seedling roots did not emerge from the containers into the pea until a level of 51-61 cm above water and an O.D.R. of c. 4 x 10-8g of cm above water and an O.D.R. of c. 4 x 10-8g O2/cm2/min were reached. At the top of the slope, where O. D. R. increased to c. 10-15 x 10-8 g O2/cm2/min, the seedlings made satisfactory shoot and root growth.—Copyright 1973, Biological Abstracts, Inc.

A CIRCUIT FOR A SELF-TIMING STOMATAL DIFFUSION POROMETER,
New South Wales Inst. of Technology, Sydney (Australia). School of Life Sciences.
P. Kenny, and P. J. McGruddy.
Agric Material Vol. 10, No. 45, p. 391,399, 1972.

Agric Meteorol, Vol 10, No 4/5, p 393-399, 1972, Illus. Identifiers: Humidity, \*Measurement, \*Porometer, \*Stomatal diffusion.

### Group 21-Water in Plants

Current stomatal diffusion porometers generally involve the measurement with stop-watch of the time taken for the cup humidity to increase from one given value to another while the cup is clamped on a leaf. The necessity of closely observ-ing the meter movement while simultaneously holding the porometer head and circuit box, operating the stop-watch and shading the leaf leads to a degree of operator inconvenience. A circuit has been developed which automatically records this time on a digital counter and allows wide adjustment of the humidity range scanned. Facilities for measuring leaf and cup temperature and their difference are also incorporated. The instrument is battery operated and portable.--Copy-right 1973, Biological Abstracts, Inc.

### 2J. Erosion and Sedimentation

AQUATIC SEDIMENTS, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 05C.

EVALUATION OF ERTS-1 IMAGERY FOR AN INVENTORY OF POST-1890 ACCELERATED Geological Survey, Tucson, Ariz. For primary bibliographic entry see Field 07C.

W73-14329

RUNOFF, EROSION, AND TILLAGE EFFI-CIENCY ON GRADED-FURROW AND TER-RACED WATERSHEDS, Agricultural Research Service, Temple, Tex. Blackland Conservation Research Center. For primary bibliographic entry see Field 04D. W73-14410

WATER YIELD AND EROSION RESPONSE TO LAND MANAGEMENT,
Agricultural Research Service, Council Bluffs,
Iowa. North Central Watershed Research Center. For primary bibliographic entry see Field 04D.

INFILTRATION, HYDRAULIC CONDUCTIVI-TY, AND RESISTANCE TO WATER-DROP IM-PACT OF CLOD BEDS AS AFFECTED BY CHEMICAL TREATMENT,

Iowa State Univ., Ames. Dept. of Soil Science. For primary bibliographic entry see Field 04D. W73-14413

RELATIVE DETACHABILITY OF SOIL PARTI-CLES BY SIMULATED RAINFALL, Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station

Soil Science Society of America Proceedings, Vol 37, No 4, p 629-633, July-August 1973. 3 fig, 4 tab,

Descriptors: \*Soil erosion, \*Impact (Rainfall), \*Overland flow, Rainfall, Energy, Erosion, Rainfall intensity, Simulated rainfall, Particle size. Identifiers: Splash erosion.

Disturbed surface soil masses of two coarsegrained granitic soils and a single fine-textured clay soil were subjected to simulated rainfall. The relative detachability of 11 soil-size fractions was determined by comparing the proportion of a given size fraction in the pretreatment soil mass with the proportion of that size fraction in the splashed soil. Tests were conducted under two levels of rainfall intensity, three degrees of slope steepness, and in the presence or absence of overland flow. Effects of rainfall intensity and slope steepness were

small. Overland flow had a pronounced effect on particle detachment resulting from raindrop im-pact. Without overland flow, soil particle sizes in the range of 110-1,450 micrometers were most susceptible to detachment by raindrop impact. With overland flow, the susceptible size range was 219-2,034 micrometers. (Knapp-USGS)

THE PROBLEM OF ASSESSING THE EROSIVE POWER OF RAINFALL METEOROLOGICAL OBSERVATIONS

onwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils. P. I. A. Kinnell.

Soil Science Society of America Proceedings, Vol 37, No 4, p 617-621, July-August 1973. 1 fig, 6 tab,

Descriptors: \*Soil erosion, \*Impact (Rainfall), Rainfall, Energy, Erosion, Rainfall intensity.

A number of rainfall parameters are used as bases for indexes of erosivity. Values for three such parameters--momentum, kinetic energy, and kinetic energy per unit horizontal area of the drop--were calculated from drop-size data. Relationships between rainfall intensity and the parameters were developed. Both raintype and geographic lo-cation influenced the parameter values. This suggests that the detachment ability of rainfall, at a given rainfall intensity, may vary between rain-types and geographic locations. However, the degree and direction of the influence depended on which parameter was being considered. The ordering of five raintypes at Miami, Florida, determined by values obtained at given rainfall intensity from the intensity-parameter regressions for momentum and kinetic energy was reversed for kinetic energy per unit horizontal area of the drop. Therefore, in the absence of data on the rate of soil detachment, it is not possible to classify the raintypes at a geographic location according to their detachment power. Rainfall parameters may only be evaluated as indexes of the detachment power of rainfall if they are determined directly and simultaneously with soil loss, and provided that the influence of runoff on soil loss is taken into account. (Knapp-USGS) W73-14415

CHANGES IN BEACH PROFILES AT CHEDABUCTO BAY, NOVA SCOTIA, FOL-LOWING LARGE-SCALE REMOVAL OF SEDI-

Bedford Inst., Dartmouth (Nova Scotia). Atlantic Geoscience Center. E. H. Owens, and G. Drapeau. Canadian Journal of Earth Sciences, Vol 10, No 8,

p 1226-1232, August 1973. 3 fig, 9 ref.

Descriptors: \*Beach erosion, \*Beaches, Sediment transport, Sedimentation, Oil spills, \*Canada, Profiles, Surf, Pollution abatement. Identifiers: \*C'hedabucto Bay (N.S.).

The effects of sediment removal on three beaches were monitored during a 1-year period following attempts to clean up an oil spill in Chedabucto Bay, Nova Scotia. Profiles of these beaches are compared with those surveyed on a high energy beach on Crichton Island which was not affected by cleaning operations. It is apparent on beaches affected by cleaning operations that sediments removed from areas beyond the limit of normal wave action have not been replaced. Excessive sediment removal can seriously alter the equilibrium of a beach and this was demonstrated by a 20m retreat of the beach crest at the eastern end of Indian Cove. (Knapp-USGS) W73-14549

ADVANCES IN NEAR-SHORE PHYSICAL SEDI-MENTOLOGY: A SELECTIVE REVIEW Florida State Univ., Tallahassee. Dept. of Geolo-

gy. W. F. Tanner. Shore and Beach, Vol 41, No 1, p 22-27, April 1973. I fig, 24 ref.

Descriptors: \*Beach erosion, \*Sedimentation, \*Beaches, \*Reviews, Sediment transport, Surf, Waves (Water), Sediment yield.

Wave energy concepts important in coastal studies are reviewed. In the general sense, coasts may have high, moderate, low, or even zero energy. Processes appear to be easier to study on moderate-to-low energy coasts. Each segment of moderate-to-low energy coasts. Each segment of coast is either in nonequilibrium, subequilibrium or equilibrium. Equilibrium is a more-or-less self-correcting balance among energy, sediment and three-dimensional geometry. An equilibrium beach, for example, may maintain its equilibrium geometry, and nevertheless shift its position landward (erosion) or seaward (accretion). These cases may be examples of equilibrium-of-scarcity and equilibrium-of-abundance. There is considerable evidence that, during the last five centuries, many of the beaches of the world have changed from abundance to scarcity. Sand budget studies inabundance to scarcity. Sand budget studies in-volve the determination of quantities of sand eroded, moved, and deposited in a single coastal eroded, moved, and deposited in a single coastail compartment or cell. On low-to-moderate energy beaches, it may be easy to balance the sand budgets. A single cell may contain subcells, between which leakage is rather important. The compartments which are reasonably well isolated from each other tend to have a size which is proportional to the general energy level. Cell bou ries may be zero energy segments, bay heads, wide inlets or estuaries, rocky headlands, or capebased sandy shoals (very large transverse bars). Studies of energy partitioning show that, in a few cells which have been examined in detail, total cells which have been examined in detail, total sediment transport absorbs a few percent of the overall wave energy available, and net unidirectional transport (net littoral drift) absorbs a few hundredths or a few tenths of one percent of total wave energy. (Knapp-USGS) W73-14572

COASTAL ICE FORMATION AND ITS EFFECT ON BEACH SEDIMENTATION, Western Michigan Univ., Kalamazoo. Dept. of Geology. R. A. Davis, Jr.

Shore and Beach, Vol 41, No 1, p 3-9, April 1973.

Descriptors: \*Beaches, \*Ice, \*Beach erosion, \*Great Lakes, Sedimentation, Freezing, Melting, Waves (Water), Surf, Ice cover, Iced lakes, Sediment transport, Seasonal.

Formation of coastal ice causes sudden and striking seasonal changes in normal coastal processes. The backbeach and foreshore zone are the first to be affected as the beach freezes and an icefoot forms. At this stage, waves and currents are essentially unaffected. As temperatures continue to decline, various forms of ice accumulate across the nearshore zone, with large ice ridges being the most prominent features. The ice cover prevents the beach and nearshore zone. As a result these areas become static during the waves and longshore currents from actir areas become static during the period of ice cover. Initial melting and subsequent runoff produces nu-merous temporary deltas, which are protected from wave attack by the ice ridges. Ice melting ng the foreshore zone exposes small ice-push along the forestore zone exposes sman ice-push features, large kettle-like depressions, and a generally irregular shoreline. Eventually the ice ridges break up and thereby allow waves to reach the beach. In a matter of hours the beach regains its usual character and all evidence of ice cover is destroyed. (Knapp-USGS) W73-14573

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### Erosion and Sedimentation—Group 2J

METHOD OF RANDOMLY DISTRIBUTING GRAINS FOR MICROSCOPIC EXAMINATION, Oregon State Univ., Corvallis. School of Oceanog-

T. C. Moore, Jr. Journal of Sedimentary Petrology, Vol 43, No 3, p 904-906, September 1973. 1 tab, 5 ref.

Descriptors: \*Particle size, \*Particle shape, \*Microscopy, Instrumentation, Laboratory tests, Analytical techniques, Equipment.

Fine, hydrodynamically heterogeneous grains may be mounted on a microscope slide in such a way that their distribution on the slide is random. The grains are settled from a well-mixed suspension onto the microscope slide where they are held in onto the microscope since where they are need in place by a thin film of gelatin. This technique al-lows the investigator to use any part of the slide as a representative subsample, and obviates the need for repeated splitting of samples and the counting of a very large number of grains. (Knapp-USGS)

INEXPENSIVE DUAL BEAM TURBIDIMETER, Rochester Univ., N.Y. Inst. of Optics. C. Lubell, T. Barry, E. Brody, and G. Hearn. Journal of Sedimentary Petrology, Vol 43, No 3, p 898-903, September 1973. 4 fig, 10 ref. NSF Grant

Descriptors: \*Turbidity, \*Measurement, \*Instrumentation, \*Light penetration, Opacity, Optical properties, Sedimentology, Suspended load. Identifiers: Turbidimeters.

A dual-beam turbidimeter can be made for under \$1000. The light source is a 2 milliwatt helium neon laser. Use of a laser eliminates the need for collimating optics. The light detector is a photomul-tiplier tube, thus permitting the measurement of low particle concentrations. The reproducibility of the transmittance is 1%. Turbidity was measured for monodisperse and polydisperse particle suspensions in waters; the results compared well with determinations of the turbidity made by use of an optical microscope and by use of a commer-cial particle analyzer. (Knapp-USGS) W73-14575

AN APPRAISAL OF THE SIGNIFICANCE OF SIEVE INTERVALS IN GRAIN SIZE ANALYSIS FOR ENVIRONMENTAL INTERPRETATION, Institute of Oceanographic Sciences, Taunton (England)

J. R. Hails, B. Seward-Thompson, and L.

Cummings

Journal of Sedimentary Petrology, Vol 43, No 3, p 889-893, September 1973. 1 fig, 1 tab, 11 ref.

Descriptors: \*Particle size, \*Sedimentology, \*Sedimentation, \*Statistical methods, Sediment transport, Provenance, Sieve analysis.

A program which uses all available data from standard sedimentological analyses, regardless of the phi interval, and which computes statistical parameters by direct integration of a linear approximation to the cumulative curve was reviewed for its use in conjunction with sieve intervals in grain size analysis for interpretation of sedimentary environments. The 0.25 phi interval produces more accurate and more meaningful results unless data can be obtained for values smaller than this interval. Although fitting a higher order equation to the cumulative curve would produce more consistent results for the 0.25, 0.5 and 1.0 phi intervals, there is no practical or theoretical justifica-tion for choosing any particular family of curves to fit a cumulative curve of this description. Therefore, a linear approximation is justified by its combination of simplicity and objectivity. (Knapp-USGS) W73-14576

COMPOSITION OF SAND RELEASED FROM THREE SOURCE AREAS UNDER HUMID, LOW RELIEF WEATHERING IN THE NORTH CAROLINA PIEDMONT, North Carolina State Univ., Raleigh. Dept. of

W. R. Mann, and V. V. Cavaroc. Journal of Sedimentary Petrology, Vol 43, No 3, p 870-881, September 1973. 5 fig, 4 tab, 22 ref.

Descriptors: \*Sands, \*Provenance, \*Weathering, \*Mineralogy, \*North Carolina, Climates, Topography, Sedimentology, Leaching.

The petrographic composition of sand-size sediment released by granitic, micaceous metamorphic, and first cycle sedimentary source areas was investigated in a portion of the North Carolina piedmont province. The region is charac-terized by a moist climate and low relief, resulting in moderate to heavy chemical weathering of the source rocks. Despite significant variation between sample sites within source areas, as well as appreciable in situ degradation of the chemias appreciator in stu degradation of the chemi-cally less stable grain types, mineralogical dif-ferences between sands from the three sources can be detected. Strong over-riding composition-sediment size relationships, however, tend to ob-scure the differences. These size correlations, which differ between source areas, reflect a characteristic imprint of the source lithology on sands released by weathering, and may be useful in differentiating the sand's origin. (Knapp-USGS) W73-14577

THE EFFECT OF GRAIN ORIENTATION ON FOURIER SHAPE ANALYSIS, Michigan State Univ., East Lansing. Dept. of

Geology.

S. E. Tilmann Journal of Sedimentary Petrology, Vol 43, No 3, p 867-869, September 1973. 1 fig, 10 ref.

Descriptors: \*Particle shape, \*Particle size, \*Fourier analysis, Sedimentology, Statistics, Statistical methods.

The Fourier shape analysis of 50 unconsolidated sand-sized quartz grains in their maximum projection plane were compared to the shape of these same grains in orientations that depart radically from the maximum projection plane. The results indicated that the shape information carried by quartz grains while in their plane of maximum projection does not differ significantly from the shape information carried by such grains while in other planes of orientation. (Knapp-USGS)

THE PROBLEM OF BEACH CUSP DEVELOP-

Glamorgan Polytechnic, Pontypridd (Wales).

Oramogan Polycenne, Policyphid (wates).
A. T. Williams.
Journal of Sedimentary Petrology, Vol 43, No 3, p
857-866, September 1973. 4 fig, 2 tab, 21 ref.

Descriptors: \*Beaches, \*Sand waves, \*Surf Beach erosion, Sedimentary structures, Rip cur-rents, Coasts, Waves (Water), Geomorphology. Identifiers: \*Hong Kong.

Cusp development on three Hong Kong beaches was studied during 1970-71, and measurements of cusp dimensions and sea state parameters were obtained. Grain-size distribution as well as permeability differences were found between horns and bays. There appeared to be a tentative correlation between the degree of bay exposure and cusp spacing. Statistical analysis revealed predominance of swash length in explaining cusp predominance of swash length in explaining cusp spacing, and this together with wave period and breaker height explained 55% of the spacing in the measured cusps. A depositional origin of horn ac-cumulation was demonstrated by means of fluorescent tracers, and a distinction was observed between cusp development by strong swash and gentle swash. (Knapp-USGS) W73-14579

A SPECIAL MECHANISM FOR VARVE FOR-MATION IN A GLACIAL LAKE, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters

Journal of Sedimentary Petrology, Vol 43, No 3, p 838-840, September 1973. 1 fig, 6 ref.

Descriptors: \*Varves, \*Lake Superior, \*Sedimentation, Pleistocene epoch, Stratigraphy, Deposi-tion (Sediments), Diagenesis, Sedimentation rates, Carbonates, Calcite, Calcium carbonate, Carbonates, Leaching.

One of the major stratigraphic units in Lake Superior is a sequence of gray varved clays formed in late-glacial time. The sediment was carried into the lake by meltwater streams flowing from the region of gray calcareous tills in the northern part of the basin. During the summer when the sedimentation rate was high, the carbonates were rapidly buried and a highly calcareous layer preserved. During the winter the sedimentation rate was greatly reduced, the carbonates were partially dissolved by the cold lake water and a low-carbonate winter layer formed. (Knapp-USGS) W73-14581

PHYSICAL PROPERTIES AND SUSPENDED MATTER OF SURFACE WATERS IN THE SOUTHEASTERN ATLANTIC OCEAN, Woods Hole Oceanographic Institution, Mass K. O. Emery, J. D. Milliman, and E. Uchupi. Journal of Sedimentary Petrology, Vol 43, No 3, p 822-837, September 1973. 13 fig, 32 ref. NSF Grant GA-28193

Descriptors: \*Suspended load, \*Atlantic Ocean, \*Ocean currents, Ocean circulation, Productivity, Sampling, Oceanography.

Samples of suspended matter in surface waters were obtained at about 750 stations in the southeastern Atlantic Ocean, Concentrations were related to patterns of upwelling as outlined by ob-servations of wind direction and speed, surface water temperature, salinity, and color, seabird dis-tribution and abundance, and the surface current pattern. The suspended matter is chiefly organic in origin owing to the high productivity of upwelled water on the continental shelf and south of the Subtropical Convergence. (Knapp-USGS) W73-14582

DISTRIBUTION AND COMPOSITION OF SUSPENDED SEDIMENT IN THE BOTTOM WATERS OF THE WASHINGTON CONTINEN-TAL SHELF AND SLOPE, Washington Univ., Seattle. Dept. of Oceanog-

raphy. E. T. Baker.

Journal of Sedimentary Petrology, Vol 43, No 3, p 812-821, September 1973. 4 fig, 1 tab, 27 ref. AEC Contract AT (45-1)-2225-T24.

Descriptors: \*Suspended load, \*Clay minerals, \*Columbia River, Continental shelf, \*Washington, Provenance, Sedimentology, Sedimentation, Mineralogy, Montmorillonite.

Samples of suspended load were collected at 26 stations from the lower Columbia River and bottom waters of the adjacent continental shelf and slope during the summer and early fall of 1971. X-ray diffraction analysis shows the montmorillonite/chlorite ratio to be a useful indicator of Columbia River-derived sediments; values vary from high (>1.0) in the Columbia River and shelf

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bottom waters, through moderate (0.96-0.65) in the head and upper reaches of three major submarine canyons on the slope, to low (<0.48) in samples from the distal portions of the canyons and the open slope areas between the canyons. Physical open slope areas between the canyons. Physical sedimentary processes, such as differential sedi-mentation and resuspension result in a continually changing clay mineral composition of the suspended load as its diffuses into the coastal ocean environment. These changes in clay mineralogy are not caused by dilution of the Columbia River suspensate or transformation of the clay minerals due to reactions with seawater.
(Knapp-USGS)
W73-14583

ORIGIN AND DISTRIBUTION OF SANDS AND GRAVELS ON THE NORTHERN CONTINENTAL SHELF OFF WASHINGTON, Observatory, Lamont-Doherty Geological

Palisades, N.Y. K. Venkatarathnam, and D. A. McMan

Journal of Sedimentary Petrology, Vol 43, No 3, p 799-811, September 1973. 7 fig, 3 tab, 30 ref. USGS Contracts 14-08-0001-10924 and 14-08-0001-

Descriptors: \*Sands, \*Gravels, \*Continental shelf, \*Provenance, \*Sedimentation, Pleistocene epoch, Washington, Glacial drift, Littoral drift, Sedimentology, Mineralogy. \*Gravels, \*Continental

Nearshore sands on the northern Washington shelf have high percentages of clinopyroxene, garnet, and amphibole that indicate local sediment supply along the coast. Orthopyroxene, which characterizes the Columbia River sediment, does not form a significant proportion of these sands, as it does in the nearshore sands to the south, between Grays Harbor and the Columbia River. In contrast to these differences, a heavy mineral-rich zone at 44 to 51 m has relatively abundant orthopyroxene all along the shelf, especially in the southern part. This indicates that orthopyroxene-rich sediments were more abudantly supplied to the southern part of the shelf in the past, or that the northward sediment drift was stronger than at present possibly due to the lack of headlands. The Chenalis River could have delivered considerable quantities of sediment during the Pleistocene. Glacial outwash exiting through Grays Harbor during lowered sea level supplied the gravel found on the adjacent inner, middle, and outer shelf. Except near the Columbia River where a blanket of modern silt covers the shelf, anomalously coarse deposits rich in heavy minerals are found discontinuously at depths of 18 to 33 m. 44 to 51 m, has relatively abundant orthopyroxene all along the shelf, espe-cially in the southern part. (Knapp-USGS)

LONGITUDINAL RIPPLES FORMED BY OVERLAND FLOW AND TIDAL CURRENTS. Colorado State Univ., Fort Collins. Dept. of Geology. M. P. Mosley.

Journal of Sedimentary Petrology, Vol 43, No 3, p 795-798, September 1973. 2 fig, 1 tab, 9 ref.

Descriptors: \*Ripple marks, \*Overland flow, \*Sheet erosion, \*Waves (Water), Unsteady flow, Sail erosion, Surf, Tides, Non-uniform flow, Soil erosion, Surf, Tides, Model studies, Hydrologic models, Sediment transport, Sedimentation, Erosion. Identifiers: Tidal currents.

Longitudinal ripple marks similar in size and ap-Longitudinal ripple marks similar in size and ap-pearance to those reported on tidal mudflats developed under the influence of artificial precipitation and overland flow during an experi-mental study of soil erosion. They appeared to be an upslope extension of the incised channel system, accomplishing the most efficient evacua-tion of water from the experimental surface. The longitudinal ripples formed under overland flow tended to be more sinuous and to branch more frequently than those formed by tidal currents. In terms of fluid flow dynamics, longitudinal ripples formed under overland flow and tidal flow may be functionally similar, but environmental conditions are quite different. That these features may develop in different environments may introduce some difficulty into interpretation of such forms found in the geologic record. (Knapp-USGS)

EVALUATION OF A CONCEPTUAL MODEL FOR THE TRANSVERSE SEDIMENT TRANS-PORT SYSTEM OF A COASTAL BARRIER CHAIN, MIDDLE ATLANTIC BIGHT, Old Dominion Univ., Norfolk, Va. Dept. of Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences; and Old Dominion Univ., Norfolk, Va. Inst. of Oceanography. G. L. Shideler.

Journal of Sedimentary Petrology, Vol 43, No 3, p 748-764, September 1973. 4 fig, 2 tab, 32 ref.

Descriptors: \*Beaches, \*Sediment transport, \*Barrier islands, Particle size, Sedimentary structures, Sedimentation, Beach erosion, Surf

Comparative size analyses of adjacent foreshore, berm, and dune sediments were conducted along a coastal barrier chain of the Middle Atlantic Bight between Cape Henry, Virginia and Cape Hatteras, North Carolina. The three genetic populations ex-hibit statistically significant textural differences. Their textural attributes are interpreted in terms of a proposed conceptual model for the transverse transport system of barrier sediments. During fair weather conditions, barrier sediments are sub jected to environmental processes resulting in the acquisition of distinctive textural response characteristics. The foreshore population is generated largely through aqueous processes associated with the normal swash-backwash regime, with only minor response to aeolian processes; whereas the berm population is generated by high water swash-backwash regimes, and is substantially modified by subsequent aeolian processes. The dune population is generated entirely by the aeolian regime, and represents a clastic filtrate derived from adjacent berm and aeolian flat deposits. The distinctive response characteristics of the three genetic ons tend to be obliterated by interpopulation feedback, and through storm homogenization by washover fans. Characteristic textural responses appear to be determined both by the types of processes and by their relative effectiveness. (Knapp-USGS) W73-14586

NEW METHOD OF FORECASTING MUD-FLOWS FROM THUNDERSTORMS (NOVYY METOD PROGNOZIROVANIYA SELEVYKH POTOKOV PO GROZAM), Akademiya Nauk SSSR, Moscow. Institut

Geografii. S. S. Korzhuyev

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 2, p 99-104, March-April 1972. 1 fig.

Descriptors: \*Mudflows, \*Thunderstorms, \*Forecasting, Cloudbursts, Precipitation (Atmospheric), Mountains, Correlation analysis, Identifiers: USSR, \*Turkmen SSR, \*Kopet-Dag.

A new method is proposed for forecasting mud flows from thunderstorm runoff. On the basis of 30 years of data, a close relation is established between thunderstorms and mudflow activity in netween tunnerstorms and mutitow activity in the mudflow-risk mountainous region of Kopet-Dag in southern Turkmenistan. The number of thunderstorms during this period was 377, and the number of mudflows was 291. The coefficient of correlation is 0.972 plus or minus 0.067. (Josefson-1868) USGS) W73-14599

BASIC PATTERNS IN THE GEOLOGIC ACTIVITY OF STREAMS IN MOUNTAINOUS AREAS (OSNOVNYEE ZAKONOMERNOSTI GEOLOGICHESKOY DEYATEL'NOSTI REK GORNYKH STRAN), Akademiya Nauk SSSR, Moscow. Geologicheskii

I. P. Kartashov. Akademiya Nauk SSSR Geologicheskiy Institut Trudy, No 245, Moscow, 1972. 184 p.

Descriptors: "Geology, "Topography, "Sedimentation, "Stream erosion, "Equilibrium, Aggradation, Degradation (Stream), Abrasion, Rivers, Streams, Gradients (Streams), Meanders, Channels, Flood plains, Deltas, Alluvium, Terraces (Geologic), Mountains, Profiles, Mapping. Identifiers: USSR, "Yakutsk ASSR, Khabarovsk Territory, Magadan Oblast, Placers, Planation.

Geologic activity of streams is divided into 3 main stages-downcutting, aggradation, and dynamic equilibrium-and 2 transitional stages-stream abrasion (transition from downcutting to equilibri-um), and floodplain constriction (transition from um), and floodplain constriction (transition from aggradation to equilibrium). Formation of topography, alluvium, and placers is examined, and characteristics of these processes in each stage of river development are discussed. The genetic classification of fluvial topographic forms, alluvium, and placers developed by the author reflects the dynamics of development of these formations and the interrelations between different fluvial geologics processes. Each and the for any activities interrelations. ic processes. Factual data for analyzing interrela tionships between relief-forming and rock-forming stonanups between relief-forming and rock-forming activities of streams are based on many years of investigations of gold placer deposits in the Yakutsk ASSR, Khabarovsk Territory, and Magadan Oblast. (Josefson-USGS) W73-14603

MOVABLE-BED SCALE-MODEL

RELATIONSHIP, Tetra Tech, Inc., Pasadena, Calif.

Prepared for Army, Coastal Engineering Research Center, Final Report, TETRAT-P-71-191-1, March 1971. 119 p, 36 fig, 3 tab, 20 ref, 3 append. DACW 72-70-C-0021.

Descriptors: Beaches, \*Coasts, \*Sediments, \*Waves (Water), Littoral. Identifiers: \*Beach profiles, \*Longshore bar formation, Scale models, Mass transport, Near shore

The problem of determining the existence of a model law for coastal movable bed scale models is considered. An experimental program has been performed and the extensive laboratory beach profile data indicate a relationship or model law between the four basic scale ratios: the horizontal profile data indicate a relationship or model law between the four basic scale ratios: the horizontal scale, vertical scale, sediment size ratio and the relative specific weight ratio. To determine the validity of the experimentally derived model law a prototype dimension beach profile is modeled in the laboratory and the results show good correla-tion. Since this law is fundamental to all beach tion. Since this law is fundamental to all beach profiles a "criterion of longshore bar formation' is proposed which successfully correlates the available data on the formation of winter and 'summer' type beach profiles. Recommendations are presented to optimize the practical application of presented to optimize the practical application of scale model technology to coastal movable beds. Information is also presented on the physical and handling properties of many materials to determine their applicability as possible model sediments. Graphical forms of the experimentally derived model law as presented for efficient tay mine their applicability as possible model sedi-ments. Graphical forms of the experimentally derived model law are presented for efficient use. In an appended paper B. Le Mehaute presents a comparison of fluvial and coastal similitude. Le Mehaute suggests that despite the fact that the knowledge in sediment transport by wave action is less advanced than in the case of steady currents, the conditions of similitude for beaches are less stringent than for rivers. An introduction to a natu-ral law of distortion for beaches is presented in analogy with the Lacey condition for rivers. (Sin-ha-OEIS) W73-14622

FLUME STUDIES OF THE TRANSPORT OF PROCESSES,
California Univ., Berkeley. Hydraulic Engineering

Lab. For primary bibliographic entry see Field 02L. W73-14623

INTRODUCTION TO COASTAL MORPHOLOGY AND LITTORAL PROCESSES, Queen's Univ., Kingston (Ontario). B. Le Mehaute, and A. Brebner. Civil Engineering Report No. 14, January 1961. 46

Descriptors: \*Coasts, \*Beaches, Erosion, Sedimentation, \*Sediment transport, \*Waves (Water), Seiches, Fluid mechanics, Breakwaters, \*Littoral

Identifiers: \*Near shore processes, Equilibrium profiles, Longshore currents, Beach slope, \*Coastal geomorphology, Wave refraction, Wave diffraction

Basic mechanisms of wave induced sediment motion on shorelines subject to erosion and accretion are discussed. Attention is given to the following subjects: coastal material and origin of beaches; waves and currents affecting beaches; motion of materials and equilibrium profile of beaches in a direction perpendicular to the shoreline; and drift transportation. (Sinha-OEIS) W73-14629

EXPERIMENTAL STUDY OF LONGSHORE CURRENTS ON A PLANE BEACH, For primary bibliographic entry see Field 08B. W73-14630

COASTAL PROCESSES AND BEACH ERO-

SION, Army Coastal Engineering Research Center, Army Coastal I Washington, D.C. J. M. Caldwell.

J. M. Catowen.
Journal of the Society of Civil Engineers, Vol 53,
No 2, p 142-157, April 1966. 3 fig. 5 tab, 7 ref.
(Also issued as Army Coastal Engineering
Research Center R. 1-67, January 1967.)

Descriptors: Beaches, Erosion, \*Beach erosion \*Coastal engineering, Ocean waves, Storms, Fluid flow, \*Littoral drift, Inlets (Waterways), Shores, \*Shore protection, Deposition (Sediments), \*Tidal effects, Waves (Water).

Identifiers: \*Near shore processes, Wave overtopping.

Fundamentals of coastal processes and their application to selected engineering problems are set forth. The beach face is an active zone with a constant shuttling of the sands back and forth along the shore. Permanent beach losses occur along most of our shores due to: (a) an excess of littora most of our softeness due to: (a) an excess of into an drift leaving a given sector; (b) material lost inland by the tidal action of inlets; and (c) material pulled offshore into deep water by local storms. The first two losses are permanent losses; the third loss may or may not be permanent depending on local conditions. The continuing section of a based on a conditions. The continuing erosion of a beach narrows the beach to where it is extremely vulnerable to severe erosion and wave overtopping during severe storms. The proper solutions to our many shore erosion problems involve basically a quantitative evaluation of the overall processes causing the erosion followed by the development of a plan to either prevent or to compensate for these losses. (Sinha-OEIS)
W73-14633

SEA-LEVEL RISE AS A CAUSE OF SHORE Florida Univ., Gainesville. Coastal Engineering

P. Bruun

r. sruun. Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 88, No WW1, Proceedings paper 3065, p 117-130, Februa-ry 1962. 4 fig. 14 ref.

Descriptors: \*Erosion, Sea level, Shores, \*Beach erosion, Geologic history, Sediment, \*Littoral drift, \*Florida, Coasts, Estuaries. Identifiers: Near shore processes, Accretion, Equilibrium profile, \*Beach profiles.

Geological history which points to the relationship between sea level variations and beach erosion is reviewed. Consideration is given to the equilibrireviewed. Consideration is given to the equilibrium profile theory. It is suggested that a rise of 0.3 m may come in 50 to 100 years and will have serious consequences for erosion along Florida shores, because it may give rise to shoreline recessions of the order of 100 ft or more on the southwest coast. There may be a time lag between the rise of the water table and the reaction in the form of erosion. This lag is more pronounced for the gentle sloping, northeastern Florida shores, than for the steep southeastern Florida shores where reactions to fluctuations come more rapidly. These steep shores present less stability than the flat shores and any change from rising to lowering, or neutral position of the sea table seems to be reflected more rapidly in these steep-slope shores. With gentle-slope shores there may be shores. With genue-stope shores there may be more phase-lag between rise of sea level and erosion. This steep-slope shores with lowering of sea level may stop eroding before the gentle-slope shore slowly turns a tendency to erosion into a tendency to accretion. All this is based on the assumption that these shores are equilibium profile shores with meaturing of configuration described. shores with maturity of configurative development. (Sinha-OEIS) W73-14638

TRACING BEACH SAND MOVEMENT WITH IRRADIATED QUARTZ, Scripps Institution of Oceanography, La Jolla, Calif.

T. K. Chamberlain. Journal of Geophysical Research Vol 64, No 1, p 41-47, January 1969. 5 fig, 2 tab, 8 ref.

Descriptors: \*Beaches, \*Sediment transport, Sand, Quartz, Tracers, \*Erosion, \*Deposition (Sediments), California, Waves (Water). Identifiers: Irradiated quartz sand, Radioactive

The mechanics of transportation of sand under the influence of wave action was studied using artifi-cally induced radioactivity. A sample of naturally occurring quartz sand is taken from the area of study, subjected to slow neutron irradiation, and then reintroduced into the area. The movement of then reintroduced into the area. I he movement of the quartz is traced by sampling the sediment on the bottom and assaying for phosphorus-32, which is the principal radio isotope formed from the slow neutron irradiation of natural quartz sands. In a field experiment, 860 g of irradiated quartz sand was reintroduced as a point source on the sea floor off Scripps Beach. The experiment showed that the dispersal of sand by wave action was more rapid than expected, and that the movement of this small amount of sand could be followed for about 7 to 24 hr. The irradiated sand was released on the bottom by divers and samples were obtained on a grid at the time intervals of 1/4, 1, 3 1/2, 7 1/2, and 24 hr, and several days later. At the point of introduction the water was 10 ft deep and the surface waves were about 1 1/4 ft high. The waves caused the sand to spread in an elliptical pattern with an elongate onshore-offshore axis. The sampling indicated that the 860 g of irradiated fine sand had been dispersed over an area of approxi-mately three-quarters of a square mile in 24 hr. The sensitivity of detection for this experiment was approximately 1 grain of sand in 100,000. (Sinha-OEIS) W73-14639

FLUORESCENT TRACER PARTICLE DETERMINATION OF THE SIZE-VELOCITY RELATION FOR FORESHORE SEDIMENT TRANS-PORT, SANDY HOOK, NEW JERSEY, Virginia Polytechnic Inst., Blacksburg. Dept. of

Geological Science. W. E. Yasso.

Journal of Sedimentary Petrology Vol 35, No 4, p 989-993, December 1965. 3 fig, 1 tab, 8 ref. Proj NR 388-057, Nonr 266 (68).

Descriptors: \*Sediment transport, \*Particle size, Ocean waves, Beaches, \*New Jersey, Coasts,

Identifiers: \*Sandy Hook (NJ), Size-velocity relations, \*Fluorescent tracers, Near shore processes.

Each of four size classes of foreshore sand from Sandy Hook, New Jersey, was color coded with daylight and ultraviolet fluorescent coating material. These tracer particles were introduced at mid-swash line on the foreshore surface at Kingmill Beach, Sandy Hook, two hours prior to high tide. During the test Atlantic Ocean waves approaching at an angle of approximately 5 degrees to the shoreline caused 5.3-second breakers of 0.73 meter maximum height. In a time-integration procedure samples were obtained by channel sampling on the foreshore along a sampling line, transverse to the foreshore, that was established 30.5 meters downdrift from the point of introduction of tracer particles. Sub-samples of the 18 samples taken during the 49.7 minutes after marked particle introduction were examined for tracer particle con-tent. Recovery data indicate particles in the smallest size class began arriving at sampling line 18.2 plus or minus 0.7 minutes after introduction: equivalent to 2.8 cm/sec average maximum transport velocity. Particles in the next largest size class began arriving 25.8 plus or minus 1.7 minutes after introduction: equivalent to 2.0 cm/sec average maximum transport velocity. However, a ma imum number of marked particles in both size classes was found in a sample taken 42.3 minutes after introduction. Only one particle in each of the two larger size classes was recovered. Particlerecovery distribution is assumed to be influenced by sample size and total weight of particles in each size class containing marked particles. Converted particle-recovery distribution is based on weight ratio of marked particles to total particles in each appropriate size class. The data indicate an inverse size-velocity relationship prevails in beach drift transport. (SinhaOEIS) W73-14640

TSUNAMIS AS GEOLOGICAL AGENTS, Western Australia Univ., Nedlands. Dept. of Geology. ary bibliographic entry see Field 02E.

W73-14648

BEACH CHANGES AT VIRGINIA BEACH, VIR-

GINIA, Virginia Inst. of Marine Science, Gloucester Point. W. Harrison, and K. A. Wagner. Available from the National Technical Informa-

tion Service as AD-612 765, \$3.00 in paper copy, \$1.45 in microfiche. Army Coastal Engineering Research Center, Misc Paper 6-64, November 1964, 25 p, 13 fig, 12 ref.

Descriptors: Beaches, Storms, \*Tidal effects, Erosion, Deposition (Sediments), \*Coastal engineering, Virginia.

Identifiers: Near shore processes, \*Virginia Beach, \*Beach profiles.

Descriptive summary of results of repeated profiles measured daily, weekly or monthly for 4

### Group 21-Erosion and Sedimentation

transects is presented. The study was not intended to present definitive analysis relating wave action to adjustments in the shore profile but rather to adjustments in the shore profile but rather serves to show magnitude of profile variations to be expected over a period of years, seasonally, or in one case, for a single violent storm. Data are also presented and discussed relating to significance of rhythmic undulations of longshore bar-trough systems as they affect range of cut and fill along offshore profiles. (Sinha - OEIS) W73-14652

BEACH CYCLES RELATED TO TIDE AND LOCAL WIND WAVE REGIME, Scripps Institution of Oceanography, La Jolla, Calif.

Cani.
D. L. Inman, and J. Filloux.
Journal of Geology, Vol 68, No 2, p 225-231,
March 1960. 3 fig, 1 tab, 1 plate, 2 ref.

Descriptors: "Tidal effects, "Sea breezes, "Berms, "Beaches, "Erosion, "Deposition (Sediments), "Waves (Water). Identifiers: Beach profiles, Wind waves, \*Gulf of

Along portions of the northwestern coast of the Gulf of California the beaches exhibit a fortnightly cycle of erosion and deposition which is related to the combined effects of the tides and the waves generated by the daily 'sea breeze'. In this area the higher waters of spring tide occur during the early afternoon when the 'sea-breeze' regime is strongest. This coincidence of maximum wave intensity during the times of highest water causes the position of the beach berm to follow the elevation of the envelope of the higher high waters in a fort-nightly cycle. A record of the beach cycle is preserved within the beach face by the bands of heavy minerals that are concentrated by wave ac-tion at the level of each high water. (Sinha - OEIS)

SIZE DISTRIBUTIONS OF MINERAL GRAINS SUSPENDED IN CHESAPEAKE BAY AND NEARBY COASTAL WATERS,

Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 02L. W73-14654

PHYSIOGRAPHICAL CONDITIONS OF THE FORMATION OF THE SEACOAST ORE FIELDS, (FIZIKO-GEOGRAFICHESKIYE NAKOPLENIYA PRIBREZHNO-MORSKOGO GENEZISA),

A. A. Aksenov. A.A. Aksenov. Available from the National Technical Informa-tion Service as AD-705 835, \$1.45 in microfiche. Trans from Teoreticheskiye Voprosy Dinamik Morskikh Veregov, p 92-102, 1964. 14 p, 2 fig. 8 ref. Naval Oceanographic Office, Wash. DC 20390. Report NOO-Trans-429, 1970.

Descriptors: \*Littoral drift, \*Coasts, Sand, Ocean waves, \*Beaches, \*Sedimentation, Surf, Littoral. Identifiers: Heavy minerals, Near shore processes, Size sorting, \*Mineral deposits.

By studying the facies of seacoasts, it was determined that sedimentary rocks provide the main source. The littoral drift of sediments caused by waves represents the general dynamical condition. The waves separate the heavy minerals on beaches, but the conditions of separation often change. The study of recent deposits discloses that they consist, as a rule, of transgressive layers with buried relics of accumulative forms. The latter in-clude fields of heavy minerals. With the redistribution of detritus differentiation of the material by size and weight takes place. The assortment takes place in shallow water at the water's edge where waves are deformed or broken. The so-called surf current runs up the beach and then flows back. The surf current forms the beach layer which represents a combination of a series of transverse layers that slant seaward. The beach layer contains strata of washed-out concentrate of heavy minerals. (Sinha - OEIS) W73-14655

SEPIMENTS OF THE JAMES RIVER ESTUA-RY, VIRGINIA, Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 02L. W73-14656

EFFECT OF PARTICLE SIZE AND DISTRIBU-TION ON STABILITY OF ARTIFICIALLY FILLED BEACH PRESQUE ISLE PENINSULA

Army Coastal Engineering Research Center, Washington, D.C.

Washington, D. B. Duane.
D. W. Berg, and D. B. Duane.
Available from the National Technical Information Service as AD-694 204, \$3.00 in paper copy,
\$1.45 in microfiche. Reprint 1-69, April 1968. Pub.
in Proceedings of the 11th Conference Great
Lakes Research, p 161-178, 1968.

Descriptors: Beaches, \*Beach erosion, Lakes, \*Groins (Structures), \*Particle size, Sediments, Sand spits, \*Coastal engineering, Distribution patterns, \*Pennsylvania, \*Lake Erie, Lake shores,

Identifiers: Nearshore processes, \*Presque Isle Peninsula (Penn), Beach stabilization, Artificial

Presque Isle Peninsula, a sandy spit on the south shore of Lake Erie, has experienced continued erosion of its lakeside shoreline ever since first attempts to stabilize and halt its natural eastward migration. For nearly 150 years numerous strucmigration. For nearly 150 years numerous accu-tures have been built on the shoreline in attempts to slow down or halt the deterioration and migra-tion of the Peninsula and consequent loss of valua-ble land. Analysis of the data indicate the test area involving coarse sand fill has undergone minimal material loss and maintained a relatively stable profile. On the basis of this experiment it is judged that definite shore stabilization occurs, with atten dant benefits such as substantially reduced nourishment requirements, from the utilization of sand fill that has size characteristics superior to that originally found on an eroding beach. (Sinha-OEIS) W73-14664

SOIL EROSION-THE UNMENTIONED POL-LUTER, Illinois State Water Survey, Urbana.

W. H. Walker.
Pollution Engineering, Vol 4, No 2, p 56-57, March-April, 1972. 1 fig.

Descriptors: \*Soil erosion, \*Erosion control, Check structures, Vegetation establishment, \*Water pollution control, Soil conservation. Identifiers: \*Soil erosion standards, Zero tillage, \*Suspended solids loads.

Soil erosion from rural areas usually remains fairly stable once agricultural land-use practices have been established. This may not be the case in urban areas because of construction. Relatively short-term soil erosion losses from construction short-term soil erosion losses from construction sites during land clearing, shaping and stabilization of new surfaces may contribute significant sediment loads (up to 50 to 150 tons per acre) to water sources. Soil erosion standards in the United States generally have been established on the premise that any rate of erosion that does not harm crops or the crop land is permissible. In many states more restrictive standards do already exist but are not rigorously enforced. If these standards were enforced all farming and construction would probably be terminated. Methods of soil conservation to reduce sediment loads in construction and agriculture are discussed. (Campbell-NWWA)

W73-14720

### 2K. Chemical Processes

ATOMIC ABSORPTION ANALYSIS OF PHOSPHATES IN WATER, Wisconsin Univ., Milwaukee. Dept. of Chemistry. For primary bibliographic entry see Field 05A. W73-14223

APPLICATION OF OXINE IN THE POLARO-GRAPHIC ANALYSIS OF ORGANOMETALLIC COMPOUNDS. MICRODETERMINATION OF CADMIUM, MAGNESIUM, ZINC, MAN-GANESE, AND COBALT,
Institut National des Sciences et Techniques
Nucleaires, Saclay (France).
For primary bibliographic entry see Field 05A.
W73-14244

SEPARATION OF MOLYBDENUM FROM TUNGSTEN, VANADIUM, IRON, URANIUM AND SEVERAL OTHER INTERFERING ELE-MENTS BY EXTRACTION OF THIOSULPHATO COMPLEX, Kurukshetra Univ. (India). Dept. of Chemistry. For primary bibliographic entry see Field 05A. W73-14246

SPECTROPHOTOMETRIC DETERMINATION

OF CALCIUM, Upper Iowa Univ., Fayette. T. S. Prokopov. Mikrochimica Acta, No 3, p 429-434, 1973. 3 fig, 2 tab. 5 ref.

Descriptors: \*Calcium, \*Aqueous solutions, \*Colorimetry, Absorption, \*Spectrophotometry. Identifiers: Chemical interference, Sample

A method was developed for determining calcium by a direct colorimetric method using sodium rhodizonate as a reagent. Standard solutions ranging from 2-200 ppm Ca (II) were prepared using calcium nitrate. The analytical procedure involved placing 1 ml of sample in a test tube, rendering it basic (pH 12) with sodium hydroxide, and adding 3 ml of 25 ppm rhodizonate solution. After shaking, the samples were transferred to cuvets for measurement of absorbance at 570 nm. The procedure is not laborious, eliminates interfering ions, and is onvenient to use. (Little-Battelle) convenient W73-14251

VERSATILE COMBUSTION-AMALGAMATION TECHNIQUE FOR THE PHOTOMETRIC DETERMINATION OF MERCURY IN FISH AND ENVIRONMENTAL SAMPLES, National Marine Fisheries Service, Ann Arbor, Mich. Great Lakes Fishery Lab. For primary bibliographic entry see Field 05A. W73-14271

POLYCHLORINATED BIPHENYLS AS A METHOD FOR CONFIRMATORY RESIDUE MEASUREMENT AND IDENTIFICATION. Food and Drug Administration. Washington. Food and Drug Administration, Washington, D.C. Div. of Chemical Technology. For primary bibliographic entry see Field 05A. W73-14276

COBALT INTERFERENCE IN THE NON--STEADY STATE CLEAN WATER TEST, Camp, Dresser and McKee, Boston, Mass. For primary bibliographic entry see Field 05A.

INTERFERENCES IN NICKEL DETERMINA-TIONS BY ATOMIC ABSORPTION SPEC-TROMETRY, California Univ., Los Angeles. Dept. of Chemis-

try. L. L. Sundberg. Analytical Chemistry, Vol 45, No 8, p 1460-1464, July 1973. 4 fig, 2 tab, 21 ref.

Descriptors: \*Nickel, \*Aqueous solutions, Heavy metals, \*Pollutant identification, Water analysis, Identifiers: \*Atomic absorption trophotometry, \*Chemical interference.

This study was undertaken to evaluate inter-ferences from Zn, Fe (III), Cu, Co, Mn (II), and Cr ferences from Zn, re (111), Cu, Co, and (11), and Ci. (III) in the atomic absorption spectrometry of nickel. Stock solutions of all but copper were prepared by dissolving the metals in HCl and diluting with water. Copper solutions were prepared by dissolving CuCl2.2H20 in water. Interferences were studied with both oxidizing and admiring a framestylene. Homes, Cher, variables reducing air-acetylene flames. Other variables were wavelength and burner elevation. Samples contained transition metal concentrations of 2000 ppm and 20 ppm Ni. The results show that interferences from Fe (III), Cu, Co, Mn (II), and Cr (III) are similar and are greatly influenced by observation height. Consequently, careful adjust-ment of this parameter can eliminate them. In a reducing flame, the Ni absorbance can be enhanced or depressed by the same concomitant, and the direction of the interferences is further dependent upon the concentration of interfering species. (Little-Battelle)

MICROANALYSIS WITH THE AID OF ION EX-HANGE RESINS. XXVI. DETECTION OF SMALL QUANTITIES OF COPPER (II) WITH BATHOCUPROINE MIKROANALYSE DISULFONATE, HILFE VON MIT IONENAUSTAUSCHERN. XXVI NACHWEIS GERINGER MENGEN KUPFE R (II) MIT BATHOCUPROINDISULFONAT, Hokkaido Univ., Sapporo (Japan). Dept. of Chemistry. For primary bibliographic entry see Field 05A. W73-14290

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RAPID, SELECTIVE METHOD FOR LEAD BY FORCED-FLOW LIQUID CHROMATOG-FORCED-FLOW

RAPHY, Ames Lab., Iowa. For primary bibliographic entry see Field 05A. W73-14295

DIRECT DETERMINATION OF PHOSPHORUS BY ATOMIC ABSORPTION FLAME SPECTROMETRY,

Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry.
For primary bibliographic entry see Field 05A. For primar W73-14296

ROLE OF SOLVENT EXTRACTION PARAME-TERS IN GOVERNING THE POTENTIAL SELECTIVITY OF LIQUID MEMBRANE ELEC-TRODES, Uppsala Univ. (Sweden). Dept. of Analytical

Chemistry. S. Back, and J. Sandblom. Analytical Chemistry, Vol 45, No 9, p 1680-1684, August 1973. 4 fig, 1 tab, 19 ref.

Descriptors: \*Selectivity, \*Solvent extractions, Zeta potential, Hydrogen ion concentration, Acids, Equations, Mathematical studies, Electri-cal properties, Membranes, Electrodes, Identifiers: \*Membrane electrodes, Liquid membranes, Extraction coefficients, Organic solvents, Ion selective electrodes.

The relationship between solvent extraction parameters and the potential selectivity of liquid membranes has been examined. An expression for the electrode potential has been derived containing measurable solvent extraction parameters. This expression is used to compare the potential selectivity of a liquid membrane-consisting of tetraal-kylammonium salts dissolved in methylene chloride-with the solvent extraction properties of the same system. The potential selectivity constant is related to the extraction constant by a square root dependence which is interpreted in terms of surface diffusion phenomena. The pH-dependence of the electrode potential in the presence of weak acids as well as the role of solvent is also examined. It is concluded that extraction processes determine the potential selectivity of processes determine the potential selectivity of liquid membranes if the extraction constants are sufficiently large and if the solvent favors the counter ions. (Holoman-Battelle)

ENVIRONMENTAL ANALYSIS PROBLEMS CREATED BY UNEXPECTED VOLATILE BERYLLIUM COMPOUNDS IN VARIOUS SAM-

ice Research Labs., Wright-Patterson Aerosr

M. S. Black, and R. E. Sievers. Analytical Chemistry, Vol 45, No 9, p 1773-1775, August 1973. 3 tab, 7 ref.

Descriptors: "Beryllium, "Gas chromatography, "Air pollution, Public health, Digestion. Identifiers: Sample preparation, Chemical recovery, "Orchard leaves, "Volatilization, Recovery, Biological samples, Wet digestion, Accuracy, Beryllium compounds, Ashing, Electron capture gas chromatography, GC-mass spec-

Analysis of orchard leaves samples for beryllium yielded inconsistent results when the samples were prepared by different methods suggesting that volatile beryllium contents may have been present. To investigate this possibility, samples of orchard leaves and air were obtained. The orchard leaves were prepared for analysis by wet digestion in an open container, by wet digestion in a flask with a reflux condenser, and by low temperature ashing in an oxygen plasma. Air samples, which were provided by EPA's Office of Air Programs, have been collected in a sampling train consisting of an EPA sampling probe, two Millipore AA filters backed by Whatman filters in series, two water impingers in series, a dry impingers to catch water condensation, and a cold tree. Samples for water condensation, and a cold trap. Samples from each section were analyzed. All analyses were by each section were analyzed. All analyses were by electron capture gas chromatography. These results were compared with those obtained by GC-mass spectrometry. The results of this study in-dicate the existence of naturally occurring volatile beryllium compounds. The various digestion and ashing procedures of orchard leaves have shown that beryllium is lost in the vapor phase at relative-ly low temperatures (less than 200 C). This sug-gests that a considerable amount (at least 90 percent) of the beryllium in the orchard leaves may be organically bound and that it is lost upon destrucorganicany bound and that it is lost upon destud-tion of the organic matrix unless precautions are taken. Analyses of the impinger samples show that beryllium content was much higher in the coll traps than in the water impingers in spite of the um compounds do exist and that volatile berylli-ium compounds do exist and that they are present in the vapor state in facilities where beryllium is machined. (Little-Battelle) fact that the cold traps came last in the flow train. This supports the contention that volatile berylli-

1-EPHEDRINE IN CHLOROFORM AS A SOLVENT FOR SILVER DIETHYLDITHIOCARBAMATE IN THE DETERMINATION OF AR-SENIC.

National Environmental Research Center, Cincinnati Ohio For primary bibliographic entry see Field 05A.

W73-14300

PREPARATION AND PROPERTIES OF THE SULFATE ION SELECTIVE MEMBRANE ELECTRODE, State Univ. of New York, Buffalo. Dept. of Chemistry. M. S. Mohan, and G. A. Rechnitz.

Analytical Chemistry, Vol 45, No 8, p 1323-1326, July 1973. 5 fig, 2 tab, 2 ref.

Descriptors: \*Fabrication, Sulfates, Anions, Electrical properties, Construction, Selectivity, Nitrates, Chlorides, Bromides, Iodides, Sulfites, Hydrogen ion concentration, Physical properties, \*Electrodes.

Identifiers: \*Ion selective electrodes, \*Membrane electrodes, "Sulfate membrane electrodes, Chemi-cal composition, Ionic interference, Perchlorates, Orthophosphates, Sensitivity, Response time, Selectivity coefficients.

Detailed information is provided concerning the construction of sulfate selective membrane elec-trodes in terms of composition, membrane preparation, and electrode assembly. Special attention is given to the effect of surface treatment on electrode response and to the attainment of optimum response characteristics by condition The effect of other ions on sulfate response is evaluated. (Holoman-Battelle) W73-14301

ULTRAPURIFICATION OF WATER ELECTROCHEMICAL AND SURFACE CHEMI-CAL WORK BY CATALYTIC PYRODISTILLA-

Ottawa Univ. (Ontario). Dept. of Chemistry. For primary bibliographic entry see Field 05A. W73-14302

CORRELATION OF ENHANCEMENT OF ATOMIC ABSORPTION SENSITIVITY FOR SELECTED METAL IONS WITH PHYSICAL PROPERTIES OF ORGANIC SOLVENTS, Murray State Univ., Ky. Dept. of Chemistry. For primary bibliographic entry see Field 05A.

ESTIMATING PRECISION FOR THE METHOD OF STANDARD ADDITIONS. Oregon State Univ., Corvallis.

I. L. Larsen, N. A. Hartmann, and J. J. Wagner. Analytical Chemistry, Vol 45, No 8, p 1511-1513, July 1973. 1 fig, 3 tab, 12 ref.

Descriptors: "Estimating, "Regression analysis, "Zinc, Aqueous solutions, Heavy metals, Statistical methods, Equations, Calibrations, Least squares method.

Identifiers: \*Standard addition technique, \*Errors, \*Precision, Orchard leaves, Uncertainty, Atomic absorption spectrophotometry, Biological

An estimate of the uncertainty term expected in the method of standard additions using linear regression analysis is presented. The method agrees favorably with the standard deviation for values which are not corrected for a blank as well as with the population standard error of difference for corrected samples. Analysis for zinc in an environmental sample yielded a concentration range within the expected value. (Little-Battelle) W73-14305

WATER CHARACTERISTICS,

Maine Univ., Orono. For primary bibliographic entry see Field 05A. For primary W73-14316

### **Group 2K—Chemical Processes**

CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES, Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 05A.

SOME INSTRUMENTS AVAILABLE NOW FOR THE MEASUREMENT OF WASTEWATER

Ionics, Inc., Watertown, Mass. Instrument Div. For primary bibliographic entry see Field 05A. W73-14321

MEASUREMENT OF ORGANIC WASTE-

WATER PARAMETERS, Battelle Memorial Inst., Columbus, Ohio. Organic Chemical Div For primary bibliographic entry see Field 05A.

THE ANALYSIS OF TRITIUM OXIDE FROM SELECTED AREAS OF THE CONNECTICUT

Connecticut Univ., Storrs. Inst. of Water Resources.

For primary bibliographic entry see Field 05A. W73-14362

THE APPLICATION OF GAS CHROMATOGRAPHY OF VOLATILE METAL CHELATES TO WATER ANALYSIS, Illinois Inst. of Tech., Chicago. Dept. of Environ-

mental Engineering.
R. A. Minear, and C. M. Palesh. Available from ACS-Div of Water, Air and Waste Chem., Publications Manager, Mellon Institute, 4400 Fifth Ave, Pittsburgh, Penn 15213, Price \$4.00. In: Preprints of Papers Presented at 165th National meeting of American Chemical Society. National Section, of American Chemical Society, April 8-13, 1973, Dallas, Tex: American Chemical Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 29, p 13-18, 1973. 4 fig, 1 tab, 5 re

Descriptors: \*Water analysis, \*Chemical analysis, Chelation, 'Gas chromatography, Chromium, Beryllium, Lead, Flame photometry. Identifiers: Atomic absorption spec-trophotometry, 'Metal chelates.

The use of volatile metal chelates for the determination of trace quantities of metals by gas chromatography and electron capture or mass spectrometer detection provides detectability limits as low as 0.01 micrograms per liter for chromium and beryllium. Two chelating agents, 2,2,6,6-tetramethyl-3, 5-heptanedione (piv) and trifluoracetylacetone (tfa) were tested with copper, chromium, nickel, iron, lead and aluminum. Reaction procedures tried were (1) direct aqueous extraction from buffered and unbuffered systems, (2) extraction from heated solutions, (3) extraction from an acid-methanol solution, and (4) scaled tube reactions with both aqueous solutions and crystal forms. (Knapp-USGS) W73-14393

THE NATURE OF CHEMISTRY IN THE NATIONAL SEA GRANT PROGRAM, National Oceanic and Atmospheric Administra-

tion, Rockville, Md.

R. B. Abel.

Available from ACS-Div. of Water, Air and Waste Chem., Publications Manager, Mellon Inst. 4400 Fifth Ave., Pittsburgh, Pa. 15213, Price \$4.00. In: Preprints of Papers Presented at 165th National Meeting of American Chemical Society, April 8-13, 1973, Dallas, Tex: American Chemical Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 74, p 77-78, 1973. Descriptors: \*Grants, \*Oceanography, \*Water pollution control, Water resources development, Environment, Water chemistry. Identifiers: Sea grants.

The National Sea Grant Program has adopted a program in chemistry as a result of national interest in environmental degradation. Normally, the Sea Grant Program reacts to, and awards grants to Universities in, the general area of pollution control where the project is itself related to another aspect of marine resource development. Sea Grant encompasses pollution programs ranging from estimates of trace metals in estuarine organisms and sediments, to studies of roles of benthic organisms as elements of ecological warning systems, studies of quality of water in bays and ayacems, studies or quanty of water in bays and estuaries, and estimates of phosphate concentra-tions in industrial waste waters. The effects of chemical concentration, nutrients, and salinity generally are investigated. (Knapp-USGS) W73-14397

WEATHERING OF BIOTITE IN SOILS OF A HUMID TROPICAL CLIMATE, Ife Univ. (Nigeria). Dept. of Soils. For primary bibliographic entry see Field 02G. W73-14412

DIRECT VAPORIZATION AND QUANTIFICA-TION OF ARSENIC FROM SOILS AND

WATER,
Texas A and M Univ., College Station. Dept. of
Agricultural Analytical Services; and Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.

For primary bibliographic entry see Field 05A W73-14416

RESPONSE OF SALINITY SENSORS TO RAPIDLY CHANGING SALINITY, Agricultural Research Service, Riverside, Calif. Salinity Lab.

For primary bibliographic entry see Field 02G. W73-14417

SIMPLEST ORGANIC ACIDS IN GROUND-WATER OF THE LOWER VOLGA REGION (GENESIS AND POSSIBLE USE IN PROSPECTING FOR OIL) (NIZSHIYE ORGANICHESKIYE ING FOR OIL) (NIZSHIYE ORGANI-HESKIYE KISLOTY V PODZEMYA (GENESIS I VOZMOZH-NOST' ISPOL'ZOVANIYA V NEFTEPOIS-KOVYKH TSELYAKH), Nizhne-Volzhskii Nauchno-Issledovatelskii In-

stitut Geologii Geofiziki, Saratov (USSR). A. S. Zinger, and T. E. Kravchik. Akademiya Nauk SSSR Doklady, Vol 202, No 3, p 693-696, 1972. 1 fig. 2 tab, 5 ref.

Descriptors: \*Geochemistry, \*Organic acids, \*Groundwater, \*Exploration, \*Oil, Oil fields, Oil wells, Natural gas, Phenols, Volatitily, Boiling, Hydrolysis, Water types, Geologic time. Identifiers: USSR, \*Volga Region, Esters.

Genetic water types ranging from low-salinity sodium bicarbonate, sodium sulfate, and magnesi-um chloride waters to calcium chloride brines were investigated for distribution of simplest organic acids in groundwater of the Lower Volga Re-gion. Butyric, acetic, and formic acids were found in all waters, while propionic acid was lacking in most samples. Total concentration of volatile acids in groundwater circulating in non-oilbearing struc-tures ranges from 0.40 to 5.0 mg/liter. Concentration of simplest organic acids in calcium chloride waters and brines of productive structures ranges from 0.65 to 45.25 mg/liter. There is a definite correlation between concentration of acids and type of hydrocarbon deposit, and a relation is established between phenol and volatile-acid concentrations in the waters. (Josefson-USGS) W73-14434

CONCENTRATION RATIOS OF SALTS AT THE SEA SURFACE AND IN RAINWATER COL-LECTED OVER THE SEA (SOOTNOSHENIVE KONTSENTRATSIY SOLEY NA POVERKH-NOSTI OKEANA I V MORSKOY ATMOSFER-NOY VLAGE), Akademiya Nauk SSSR, Moscow. Institut Oke-

V. D. Korzh

Akademiya Nauk SSSR Doklady, Vol 202, No 2, p 322-324, 1972. 1 tab, 12 ref.

Descriptors: "Geophysics, "Sea water, "Surfaces, "Rain water, "Salts, Carbonates, Sulfates, Chlorine, Evaporation, Equations. Identifiers: USSR.

Rainwater collected over the sea contains all the principal salts found in seawater. Average chlorine ratios for Na and Mg in rainwater over the sea are almost identical to those in the surface film of the sea. Good agreement is also observed in the case of boron. Average chlorine ratios for Ca, K, and SO4 in rainwater are, in some instances, higher than those calculated for the surface film. Average chlorine ratios for carbonates in rainwater are much higher than calculated CO3/C1 ratios in the surface film. The chlorine ratio of surface-active components of seawater is, in the first approxima-tion, independent of their physical and chemical properties and depends mainly on their concentra-tion in seawater. Average chlorine ratios in rainwater collected over the sea are related to the ratios at the sea surface. Deviations from this reflect fractionation of salts from the sea in the atmosphere, depending on meteorological, geogra-phisal, and other conditions. (Josefson-USGS) W73-14435

SIMPLE ARRANGEMENT FOR THE DETEC-OGRAPHIC ELUATES, (EINFACHE ANORD-NUNG ZUM NACHIWEIS VON SCHWEFEL IN GAS-CHROMATOGRAPHISCHEN ELUATEN), Universitaet des Saarlandes, Saarbruechen (West Germany). Institut fuer Analytische Chemie und For primary bibliographic entry see Field 05A. W73-14438

THE SPECTROPHOTOMETRIC DETERMINA-TION OF PALLADIUM WITH 4- ((5-CHLORO--2-PYRIDYL)AZO)-1,3-DIAMINOBENZENE, Government Industrial Research Inst., Nagoya (Japan). For primary bibliographic entry see Field 05A. W73-14440

ATOMIC ABSORPTION AND FLUORESCENCE SPECTROMETRY WITH A CARBON FILA-MENT ATOM RESERVOIR. PART XIII. THE DETERMINATION OF CHROMUM WITH A FULLY ENCLOSED ATOM RESERVOIR. mperial Coll. of Science and Technology, London (England). Dept. of Chemistry. For primary bibliographic entry see Field 05A. W73-14441

THE FLUORIMETRIC DETERMINATION OF MERCURY,
Dalhousie Univ., Halifax (Nova Scotia). Trace
Analysis Research Centre. For primary bibliographic entry see Field 05A. W73-14442

ISOTACHOPHORESIS ON PAPER. PART II. THE SEPARATION OF AG (I), TL (I), HG2 (2 PLUS) AND PB (II), Consiglio Nazionale delle Ricerche, Rome (Italy). Laboratorio di Cromatografia. For primary bibliographic entry see Field 05A. W73-14449

A PHOTON COUNTING DEVICE FOR THE MEASUREMENT OF NANOSECOND AND MICROSECOND KINETICS OF LIGHT EMISSION FROM BIOLOGICAL SYSTEMS, MSU-AEC Plant Research Lab., East Lansing, Mich.
For primary bibliographic entry see Field 05A.
W73-14453

DETERMINATION OF ALUMINIUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY AFTER CHELATION WITH OXINE AND EXTRACTION WITH METHYL ISOBUTYL KETONE, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils. For primary bibliographic entry see Field 05A. W73-14454

THE RELATIONSHIP BETWEEN SOIL STRUCTURE FACTOR AND BOTH SOLUBLE AND EXCHANGEABLE SODIUM AND CALCIUM IN THE NILE ALLUVIUM OF EGYPT, Cairo Univ., Giza (Egypt). Dept. of Soils. For primary bibliographic entry see Field 02G. W73-14474

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION MASS SPECTROMETRY: SU-FONATES, SULFATES AND THIOSULFATES, Pennsylvania State Univ., University Park. Dept. of Entomology.
For primary bibliographic entry see Field 05A. W73-14546

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1971-NOVEMBER 30, 1972, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 04A. W73-14548

MINERAL AND THERMAL WATERS OF CANADA, Geological Survey of Canada, Ottawa (Ontario). For primary bibliographic entry see Field 02F. W73-14607

### WATER IN BIOLOGICAL SYSTEMS, VOL 3.

Consultants Bureau: New York, N.Y.; London, England. M. F. Vuks, A. I. Sidorova, editors. 1971. 82 p. Illus. Identifiers: \*Biological systems, Books, Organisms, Rats, \*Water properties, Water chemistry,

This book consists of selected papers presented at the continuing seminar on the structure and role of water in living organisms at the Physics Institute of Leningrad State University. The first section contains papers on the following topics: hydrophobic bonding in dilute aqueous nonelectrolyte solutions; resolution into components of the profiles of IR absorption bands; the structure of water; and coordination-number fluctuations in water. The next section includes papers on the following aspects of water in biological systems: use of graph-theory methods to describe the structure of water; self-diffusion constants of water in protein solutions and latex suspensions; state of water in molecular complexes of hexamethylene tetraamine with inorganic-salt crystal hydrates; and investigation of tissue water metabolism in white rats by IR spectrometry. The final section includes papers on the following; state of water in dispersed materials; optical constants of liquid water; and mechanism of water-structure ordering in solutions of nonpolar molecules. Numerous tables and graphs are included, and each paper ends with a list of literature cited.—Copyright 1973, Biological Abstracts, Inc. W73-14650.

### 2L. Estuaries

MARINE AND ESTUARINE POLLUTION, California State Univ., Long Beach. Dept. of Biology. For primary bibliographic entry see Field 05B. W73-14266

PRELIMINARY SURVEY OF MERCURY AND OTHER METALS CONTAINED IN ANIMALS FROM THE FRASER RIVER MUDELATS, British Columbia, Univ., Vancouver. Inst. of Oceanography. For primary bibliographic entry see Field 05B. W73-14293

ECOLOGICAL EVALUATION OF MULTIUSE WATERS RECEIVING PRIMARY TREATMENT EFFLUENT PRIOR TO A MAJOR FLOW INCREASE,
Connecticut Univ., Storrs. Inst. of Water Resources.

Resources.
For primary bibliographic entry see Field 05C.
W73-14361

HYDRODYNAMICS OF ESTUARINE RIVER REACHES AND OFFSHORE ZONES OF NON-TIDAL SEAS (GIDRODINAMIKA USTYPEVYKH UCHASTKOV REK I VZMORIY BESPRILIV-NYKH MOREY).

Zakavkazskii Nauchno-Issledovatelskii Gidrometeorologicheskii Institut, Tiflis (USSR). T. G. Voynich-Syanozhentskiy. Zakavkazskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 46 (52), Leningrad, 1972. 204 p.

Descriptors: "Hydrodynamics, "Hydraulics, "Estuaries, "Rivers, "Oceans, Sea water, Saline water, Fashwater interfaces, Mixing, Tides, Winds, Waves (Water), Currents (Water), Density currents, Density stratification, Slopes, Sediment discharge, Sediment transport, Bed load, Suspended load, Equations.

Identifiers: USSR, Halocline, Countercurrents.

Studies are made of hydraulics of sediment-carrying flows in channels with deformable boundaries, hydrodynamics of waves and currents in estuarine offshore zones, and hydraulics of a halocline in mouths of nontidal seas. Special attention is paid to bed-load and suspended-load transportation by rivers and to stability of density currents. (Josefson-USGS) W73-14431

CHLORINE AND TEMPERATURE STRESS ON ESTUARINE INVERTEBRATES, Academy of Natural Sciences of Philadelphia, Benedict, Md. Benedict Estuarine Lab. For primary bibliographic entry see Field 05C. W73-14447

ARTIFICIAL AERATION AS A SUBSTITUTE FOR WASTEWATER TREATMENT, For primary bibliographic entry see Field 05G. W73-14464

MONROES: A TYPE OF SO-CALLED MUD VOLCANOES IN TIDAL FLATS, Centre de Recherches Forestiere des Laurentides, Quebec. L-C. Dionne.

J-C. Dionne.

Journal of Sedimentary Petrology, Vol 43, No 3, p. 848-856, September 1973. 6 fig, 1 tab, 58 ref.

Descriptors: \*Sedimentary structures, Mud, \*Mud flats, \*Ice, Intertidal areas, Ice breakup, Rivers, Ice loads. Identifiers: \*Mud volcanoes, Monroes, \*St Lawrence estuary. Small mud mounds occur in tidal flats of the St. Lawrence Estuary, Quebec, Canada. They are observed during break-up at Montmagny, 65 km NE of Quebec City, and at a few other localities. They occur generally in groups, and occasionally in isolation in relatively soft mud, have a rounded conical shape with occasionally a nipple at the top, steep slopes (40 to 65 deg), and are 5 to 25 cm in diameter, and 5 to 20 cm high. They develop under the icefoot as a result of load pressures which expel air and possibly also water trapped under surficial soft mud layer and thin ice laminae during icefoot formation, in late fall. They characterize mud tidal flats of cold regions. (Knapp-USGS) W73-14580

EVALUATION OF A CONCEPTUAL MODEL FOR THE TRANSVERSE SEDIMENT TRANSPORT SYSTEM OF A COASTAL BARRIER CHAIN, MIDDLE ATLANTIC BIGHT, Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences; and Old Dominion Univ., Norfolk, Va. Inst. of Oceanography. For primary bibliographic entry see Field 02J. W73-14586

EFFECT OF FISH REMOVAL ON THE GROWTH AND CONDITION OF WHITE SHRIMP, PENAEUS SETIFEROUS (LINNAEUS), IN BRACKISH PONDS, Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.

J. C. Parker, H. W. Holcomb, Jr., W. G. Klussman, and J. C. McNeill IV.

Available from NTIS, Springfield, Va. 22151 as COM-72-11134 Price 33.00, printed copy; \$1.45 microfiche. Texas A and M University Sea Grant Program Report TAMU-SG-72-701, June 1972. 12 p., 4 fig., 1 tab., 3 ref. SG2-35213.

Descriptors: \*Shrimp, \*Brackish-water fish, \*Brine shrimp, \*Texas, Fish populations, Growth rates, Ponds, Research and development, Methodology, Ecosystems, Environmental effects, Fish, Biology, Aquatic animals, Marshes. Identifiers: \*White shrimp, Brackish ponds, Fish removal.

The effect of fish removal on growth and condition of juvenile white shrimp was studied in two brackish ponds near West Galveston Bay, Texas. After 77 days, shrimp in the pond in which the fish were removed averaged 12.3 mm longer and 4.0 g heavier than those in the pond with fish and seine samples indicated that shrimp abundance had noticeably declined in the pond with fish. It was concluded that fish not only prey on shrimp, thus reducing their numbers, but also compete with them for supplemental and natural feeds, thus depressing their growth rate. (Woodard-USGS) W73-14587

THE CIRCULATION OF PRINCE WILLIAM SOUND,

SOUND, Alaska Univ., College. Inst. of Marine Science. R. D. Muench.

K. D. Muencn. Available from NTIS, Springfield, Va. 22151 as E73-10291 Price \$3.00, printed copy; \$1.45 microfiche. ERTS-1 Contract project report to NASA, February 20, 1973. 10 p. NAS5-21833.

Descriptors: "Water circulation, "Gulfs, "Sounds, \*Aerial photography, "Alaska, Remote sensing, Satellites (Artificial), Sediment discharge, Currents (Water), Coasts, Estuaries, Data collections, Winds, Tides, Streamflow. Identifiers: "River sediment plumes, "Prince William Sound region (Alaska).

The feasibility was determined for studying surface circulation in coastal waters using surface visible properties observed from ERTS-1 imagery and surface water circulation in the Prince William Sound region (Alaska). Circulation patterns deduced from oceanographic data are correlated

### Group 2L—Estuaries

with features seen on the ERTS imagery. Results suggest that sediment-laden plumes of freshwater from rivers may be useful tracers of surface water motion due to their high visibility. The two usable images obtained to date corroborate that westerly flow was occurring in the Gulf of Alaska just south of Prince William Sound, and that an inflow into Prince William Sound was occurring concurrently with flood tides on both occasions. River plumes are useful tracers, but poor weather conditions somewhat limit the use of satellite imagery. (Woodard-USGS) W73-14588

HISTORY OF THE SOUTH CAROLINA OYSTER,

South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Center. W. J. Keith, and R. C. Gracy.

Available from NTIS, Springfield, Va. 22151 as COM-73-10065 Price \$3.00, printed copy; \$1.45 microfiche. South Carolina Office of Marine Conservation, Management and Services Educational Report No 1, March 1972. 19 p, 18 fig, 15 ref.

Descriptors: \*Oysters, \*Estuaries, \*South Carolina, History, Spawning, Growth rates, Productivity, Environmental effects, Tidal effects, Salinity, Sedimentation, Water temperature, Water quality, Water pollution effects, Industrial wastes, Sewage effluents, Commercial shellfish,

Within the borders of South Carolina are approximately 2,2000 miles of saltwater creeks, bays, sounds and rivers. Many of these bottoms support oyster beds. Some 7,059 acres of intertidal oyster grounds are either under private lease or inclu in Public Recreational Shellfish Grounds. The modern oyster industry had its beginnings in the nineteenth century. Commercial production peaked shortly after the beginning of the twentieth century. Current harvesting problems hold annual production to about 250,000 bushels. However, in terms of dollar value the oyster in South Carolina is the second most valuable seafood product. South Carolina oysters have a wide variety of shapes and sizes. This diversity of configuration depends upon the place the set occurs, subtidal or intertidal, and the growing conditions present at the place of set. The most common type of growth produces groups known as the 'cluster oyster'. These oysters grow in the intertidal zone and are formed by successive yearly sets on the older oysters. Steam canneries prefer the larger clusters which can be more economically harvested and processed. Today, the Ashley River produces no oysters commercially. The Ashley River is and has been for some years heavily polluted with sewage and mill waste. This pollution may have been the cause of the decrease in the size of the oysters of today. (Woodard-USGS) W73-14589

ESTUARINE AND COASTAL WATER DYNAM-ICS CONTROLLING SEDIMENT MOVEMENT AND PLUME DEVELOPMENT IN LONG ISLAND SOUND,

Geological Survey, Hartford, Conn.

F. H. Ruggles Jr. Available from NTIS, Springfield, Va. 22151 as E73-10378; Price \$3.00, printed copy; \$1.45 microfiche. Progress Report to NASA, Goddard Space Flight Center, February 28, 1973. 1 p.

Descriptors: \*Mixing, \*Estuaries, \*Sounds, \*Aerial photography, \*New York, Inflow, Saline water-freshwater interfaces, Salinity, Movement, Sediment transport, Streamflow, Remote sensing, Satellites (Artificial), Hydrologic data, Salinity, Chemical stratification, Analytical techniques. Identifiers: \*Long Island Sound (NY), \*Connecticut River (Conn), Inflow plumes.

As the Connecticut River flows into Long Island Sound, large plumes develop during the mixing of ocean and estuarine waters. Plumes were delineated for July 28, October 8, October 27, and delineated for July 28, October 8, October 27, and December 2, 1972, by analyzing ERTS-1 imagery with the SRI Electronic Satellite Image Analysis Console (ESIAC). Because the chemical and physical composition of the plume and ocean water were not too different the ESIAC was utilized to expand the scenes and subject the transparencies to varying combinations of viewing techniques to identify and delineate the plumes. Best results were obtained when band 5 transparencies were used Indications are, when the parencies were used. Indications are, when the scene being analyzed is predominantly in the first two steps of the gray scale, it is best to use the negative transparencies. When the analysis is being done above the first two steps of the gray scale, it is best to use the positive transparencies. W73-14590

FORECAST OF THE 1972 PINK SALMON RUNS, SOUTHEASTERN ALASKA,

RUNS, SOUTHEASTERN ALASKA, Alaska Dept. of Fish and Game, Juneau. Div. of Commercial Fisheries. K. E. Durley, and M. C. Seibel. Available from NTIS, Springfield, Va. 22151 as COM-72-11432 Price \$3.00, printed copy; \$1.45 microfiche. Informational Leaflet No 158, July 1972. 39 p, 6 fig, 6 tab, 6 ref.

Descriptors: "Pink Salmon, "Anadromous fish, \*Fish migration, "Fish harvest, "Alaska, Forecast-ing, Analytical techniques, Fish populations, Pacific Ocean, Estuaries, Environmental effects. Identifiers: "Pink Salmon runs forecasting (Alaska), Fish tagging.

Results of the 1971 preemergent fry sampling in-dicate a return in 1972 of 13.7 million pink salmon to southern Southeastern Alaska and a return of 12.9 million to northern Southeastern Alaska for a total return of 26.6 million pinks. Although the total magnitude of the run appears relatively strong, the forecast by district and timing segments indicates that returns to certain areas will be very weak. The harvest in southern and northern Southeastern Alaska is expected to be approximately 7.7 million and 8.9 million respectively. Tagging studies have indicated that upon entering the offshore waters of Southeastern Alaska pink salmon separate into two groups, the northern group entering via Icy Strait and the lower Chatham Strait and the southern group entering via Sumner Strait and Dixon Entrance. (Woodard-W73-14591

RESTORATION OF ALABAMA'S SUPPLY OF SEED OYSTERS, Alabama Dept. of Conservation and Natural

Resources, Montgomery. J. H. Crance.

Available from NTIS, Springfield, Va. 22151 as COM-72-11199 Price \$3.00, printed copy; \$1.45 microfiche. Completion Report to NOAA, Na-tional Marine Fisheries Service, August 1969. 2 p.

Descriptors: \*Oysters, \*Fisheries, Fish popula-tions, \*Fish management, \*Alabama, Estuaries, Eccosystems, Ecology, Aquiculture, Shellish, Growth rates, Fish reproduction, Water pollution effects, Mortality.
Identifiers: \*Oyster planting, Cedar Point reefs

A shell planting program was begun during 1968 in an effort to restore the supply of seed oysters at Cedar Point reefs in Alabama. A total of 143,127 barrels of shells were planted. Spat set on shells planted in the three areas during 1968 averaged 1.6 papt per shell in Area 3, 4.8 spat per shell in Area 2 and 5.8 spat per shell in Area 1, one month following planting. (Woodard-USGS) W73-14595 A shell planting program was begun during 1968 in

OCEANOGRAPHY (OKEANOGRAFIYA). Far Eastern Hydrometeorological Research Inst., Vladivostok (USSR).

Dal,nevostochnyy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 37, Leningrad, G. G. Chalenko, editor, 1972. 107 p.

Descriptors: \*Oceanography, \*Pacific Ocean, \*Subarctic, Sea water, Sea level, Tides, Thermal stratification, Convection, Temperature, Thermal conductivity, Water structure, Dissolved oxygen, Hydrogen ion concentration, Straits, Meteorology, Synoptic analysis, Stations, Forecasting, Measurement, Winter. Identifiers: USSR, \*Soviet Far East, Kurile Islands, Sea of Okhotsk, Heat exchange.

Dynamics and structure of waters in the subarctic zone of the Pacific Ocean were investigated in this collection of 9 papers prepared by the Far Eastern Hydrometeorological Scientific Research Institute in Vladivostok. Studies are made of dissolved oxygen and pH in Kurile Islands straits in winter and of surface-water temperatures and thermal conductivity in the Sea of Okhotsk, and methods are uccurity in the Sea of Okhotsk, and methods are developed for forecasting average monthly air temperature anomalies for December-April for 25 coastal hydrometeorological stations in the Soviet Far East. (Josefson-USGS) W73-14597

STUDENT PROJECTS ON COASTAL ZONE AND OFFSHORE RESOURCES MANAGE-

MENT,
Massachusetts Inst. of Tech., Cambridge.
S. Resnick, J. Nichols, R. Chertow, and R. Dwyer.
Available from the National Technical Information Service as COM-73-10262. Report No.
MITSG 72-13 and Index No. 72-313-Nd1, June 30, 1972, 146 p, 1 fig, 4 tab, 11 and 8 ref. NOAA Sg 2-

Descriptors: \*Coasts, Water resources, \*Water pollution effects, \*Waste disposal, Natural resources, \*Thermal pollution, Economics, Management, \*Cost-benefit analysis, \*Electric industry, \*Biomass, Outfalls, Massachusetts.

Identifiers: Woods Hole (Mass), Ocean outfall, Electric utilities, Narragansett Bay (R.I.), Species

Two student projects on coastal zone and offshore resources management are presented. The first, 'Environmental Cost-benefit Analysis, Regulatory Administration, and the Financial Administration Administration, and the Financial Administration of Electric Utilities', represents an effort to apply marginal techniques and a limited knowledge of technology to establish a framework of approach to a complex set of problems which our society faces today. In the second, 'Some Experiments Relating to the Woods Hole Outfall', it was concluded that the observable effects of the outfall appear to be limited to a radius of less than 10 me. appear to be limited to a radius of less than 10 meters about the outfall. Within this radius, there are changes in the summer and fall community, with respect to dominant species diversity and biomass. In the winter, there was almost no significant dif-ference. (Sinha-OEIS) W73-14615

A REVIEW OF THE CHARACTERISTICS, BEHAVIOR AND DESIGN REQUIREMENTS OF TEXAS GULF COAST TIDAL INLETS, Texas A and M Univ., College Station. Dept. of

Civil Engineering. E. J. Schmeltz, and R. M. Sorensen.

Avialable from the National Technical Informa-tion Service as COM-73-10695. Texas A and M University, Sea Grant Program. Report No C.O.E. 156 and TAMU-SG-73-202, April 1973. 88 p, 21 fig, 4 tab, 65 ref. NOAA-04-3-158-18.

Descriptors: \*Coasts, \*Inlets (Waterways), Tidal waters. Hydraulics, \*Design criteria, Stabiliza-

tion, Fresh water, Littoral drift, \*Sediment transport, \*Texas.
Identifiers: \*Tidal inlets, Tidal waves, Inlet

design, Artificial inlets.

Characteristics, behavior and design requirements of Texas Coast tidal inlets are reviewed. The characteristics of natural inlets are summarized under the following heading: inlet formation, shoal under the following neading: miet formation; should areas, offshore bar, spit formation and channel migration, secondary channels, sediment size distribution, regional peculiarities, and select Texas Inlets. Tidal wave propagation is discussed. Pertinent factors influencing inlet stability and configuration, are littoral drift, wave action, current velocities in inlets, geometry, bottom shear, sediment load, and fresh water input. Inlet hydraulics, stability criteria, artificial stabilization an available design procedures are discussed. Hydraulic equations generally used to describe the flow in a tidal inlet are presented along with an ex-planation of the simplifying assumptions normally made. (Sinha - OEIS) W73-14618

A NUMERICAL MODEL OF A FJORD ESTUA-RY. I. BASIC CONSIDERATIONS AND PROPOSED FINITE DIFFERENCE SCHEMES, Alaska Univ., College. Inst. of Marine Science. J. B. Matthews

Report No. R72-15, October 1972. 71 p, 2 fig, 3 tab, 32 ref, 1 append. ONR-N00014-67-A-0317-0002.

Descriptors: \*Estuaries, \*Weather forecasting, Circulation, Diffusion, \*Fjords, Equations, \*Numerical analysis, \*Mathematical models, \*Alaska. Identifiers: Coordinate systems, \*Finite dif-ference equations, Heat diffusion, Eddy diffusion, Boundary conditions.

Physical and numerical considerations necessary rhysical and underteal considerations necessary to construct a full oceanographic numerical model of a fjord estuary are set forth. A discussion of a coastal model is included and details of choice of grid and the handling of boundary conditions are given. Consideration of techniques used in numerical weather forecast models is included because some can be applied in coastal models. The grid arrangement, finite difference equations and suggested methods for tackling boundary considera-tions are given for a three dimensional model with time. It is proposed that a vertical two dimensional model be used as the starting point for a fjord model experiment. It is suggested that this model would give a good approximation of the circulation patterns while having an order of magnitude improvement on computer time over the 3D model. The 2D model should allow the importance of dif-ferent parameters, such as eddy diffusion of heat nd momentum, to be experimented with on a sim ple model for many cases before the 3D models are attempted. The review of previous modeling work indicates that physical boundaries and the manner in which they are treated are likely to be major new problems to be solved in coastal models. Also proposed is a three dimensional ten layer model and a set of finite difference equations. A simplification to a vertical-longitudinal fjord model is made and the set of equations is included. (Sinha-OEIS) W73-14619

COPEPOD INDICATORS OF SURFACE WATER MOVEMENTS OFF THE OREGON COAST, Oregon State Univ., Corvallis. Dept. of Oceanog-

F. A. Cross, and L. F. Small.

Limnology and Oceanography, Vol 12, No 1, p 60-72, January 1967. 6 fig, 1 tab, 25 ref.

Descriptors: \*Copepods, \*Bioindicators, \*Up-welling, Rainfall, Runoff, River flow, Water pro-perties, Coasts, Oregon, \*Columbia River, \*Cur-rents (Water), Movement, Water circulation

Identifiers: Davidson current, Acartia danae, Centropages mcmurrichi, Near shore processes, TSP diagrams, River plumes.

Two small copepods, Acartia danae and Centropages mcmurrichi, were used as reciprocal indicators of seasonal surface current changes off the Oregon coast in 1961 and 1962. A. danae was found inshore and offshore in winter, indicating the northward flow (with an onshore component) of the Davidson Current. C. mcmurrichi was found inshore in early summer and farther offshore by late summer, indicating a southerly flow (with an offshore component). In the spring and fall, these species occurred together inshore, indicating a transitional state. Temperature-salinity-plankton (TSP) diagrams were used to examine the relationships between distributions of the copepods and local processes affecting near-surface water pro-perties (upwelling, rainfall and runoff, and the Columbia River plume). These diagrams emphasized that the major effect on copepod distribution was the seasonal shift of surface currents, with rainfall and runoff possibly affecting the inshore distribution of A. danae in winter. Upwelling had no apparent effect on the distribution of either species. Columbia River discharge, which of either species. Columbia River discharge, which flows southerly in summer, probably overwhelmed the general offshore (westerly) movement of surface currents, and hence the offshore movement of C. memurrichi, near the mouth of the river. The effect of the Columbia River plume farther out to sea was not shown conclusively to have an effect on the distribution of either species in summer. (Sinha-OEIS) W73-14620

**ENVIRONMENTAL EFFECTS OF HYDRAULIC** 

DREDGING IN ESTUARIES, Alabama Marine Resources Lab., Dauphin Island. For primary bibliographic entry see Field 05C. W73-14621

FLUME STUDIES OF THE TRANSPORT OF SEDIMENT IN ESTUARIAL SHOALING PROCESSES,

California Univ., Berkeley. Hydraulic Engineering Lab.

Final Report prepared for Army Engineer District, San Franciso, June 1962. 110 p, 35 fig, 3 tab, 23 ref, 2 appen. DA-04-203 CIVENG-59-2.

Descriptors: Estuaries, \*Bays, \*Sediment transport, Deposition (Sediments), Coastal engineering, Sedimentation, Hydraulics, Flocculation, Viscosity, Particle size, Clay minerals, Shear strength, Flumes.

Identifiers: "San Francisco Bay, "Shoaling processes, Gravity flow, Fluid mud, Bed shear, Bed structure.

The object was to obtain qualitative knowledge of the transport and deposition processes of San Francisco Bay sediments and to relate these processes to properties of the sediment materials and to the flow of the suspending medium. Mea-surements of deposition and scour from flowing water were made in a hydraulic flume. Some sam-ples required laboratory analyses, others such as measurements of sediment properties were made under bench-top conditions. Studies made were: particle size distribution, clay mineral analysis, non-crystalline components, flocculation, shear strength of flocs, settling and consolidation, viscosoty of sediment suspensions, and deposition from flowing salt water. Applications of laboratory findings to bay sediment transport encompassed study of shoaling processes. The following statements concluded the study. (1) Cohesive sediment is transported long distances in suspension as floes. (2) Suspended sediment can be deposited only at bed shears less than a critical value; deposition occurs more rapidly at lower shears. (3) The deposition rate is sensitive to the flocculation rate. Flocculation is enhanced by the suspended sediment concentration, by the sizes and size distribution of flocs, and by internal shearing rates.
(4) Sediment in the 'fluid mud' state can flow from rapid deposition areas into adjacent areas by gravity. (5) Above a given bed shear, sediment can be resuspended by bed failure or erosion, depending on bed structure. (Sinha-OEIS) W73-14623

THE TWO-DIMENSIONAL FLOW OSCILLA-TIONS OF A FLUID IN A SPINDLE-SHAPED BASIN: APPLICATION TO PORT KEMBLA OUTER HARBOUR, N.S.W., AUSTRALIA, Wollongong Univ. Coll. (Australia). Dept. of Mathamatics.

D. J. Clarke, and N. D. Thomas. Australian Journal of Marine and Freshwater Research Vol 23, No 1, p 1-9, June 1972. 4 fig. 5

Descriptors: \*Harbors, \*Storms, \*Mathematical models, \*Ocean waves, Resonance, Synthetic hydrology, Flow characteristics. Identifiers: Long waves, Progressive waves, \*Australia coast (N.S.W.).

Port Kembla Outer Harbour has a history of severe ranging during storm activity, and hence a knowledge of its resonant behavior is a necessary requirement towards understanding the cause of the range action. The Harbour has been shown to be suitably approximated by a spindle shape, which is the name given by Hidaka (1931) to a basin whose surface perimeter is defined as the intersection of two confocal parabolae. Hidaka's results are enlarged; more basic harmonics being These are then applied to the Outer Harbour which is assumed to be excited by a fully formed clapotis with an antinode at the entrance. The two particular harmonics which are most likely to be excited are found to have the same period of 153 sec. Experimental evidence has given long wave periods in the Harbour as 150 and 160 sec The resonant mode corresponding to a period of 54 sec is found to have a large amplification factor at the entrance to the Inner Harbour, and this may be compared with model study results where at 56-58 sec the range action is greatest. (Sinha-OEIS) W73-14624

MEASUREMENTS OFF OXNARD, CALIFORNIA, Naval Civil Engineering Lab., Port Hueneme,

For primary bibliographic entry see Field 08B. W73-14625

REFRACTION OF DISPERSIVE WAVES ON A

BEACH, Naval Civil Engineering Lab., Port Hueneme, Calif For primary bibliographic entry see Field 08B. W73-14628

TIME SENSING AND ANALYSIS OF COASTAL

Virginia Inst. of Marine Science, Gloucester Point.

virginia Inst. of Marine Science, Gloucester Point. M. Nichols, and M. Kelly. In: Remote Sensing of the Environmental, Proc of 8th International Symposium held at Willow Run Laboratories, Ann Arbor, Michigan, October 1972. p 969-981, 1972, 10 fig, 9 ref. ONR N00014-72C-0268.

Descriptors: Photography, \*Sediment transport, Plankton, \*Estuaries, \*Remote sensing, \*Satellites (Artificial), \*Aerial photography, \*Coasts. Identifiers: Tonal patterns, Densitometry.

Sequential photographs from aircraft and satellites provide a source of data for studying dynamic fea-tures of coastal waters. Procedures for detecting

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features follow several approaches; (1) application reatures tottow several approaches; (1) application of sequential signatures, (2) inferences from hydraulic flow patterns, (3) simple comparative analysis. To quantitatively detect tonal changes, images in two or more frames must have proper registration and comparable tones, i.e. tones free of photographic difference and changes of solar illumination. Tonal difference is removed by nor-malizing successive time frames. Control points with stable reflectance are selected, their densities are measured in successive frames, differences determined and the resulting linear correction is applied to the density distribution of transient tonal areas of water. Once tones are brought to a common density reference, differences of image density in the same geographic area are deter-mined between frames taken from time to time, areas of equal change are delineated and further related to causal processes or impacts. Normalizrelated to causal processes or impacts. Normaliz-ing and numerical differencing is best accom-plished by employing a digital or computerized microdensitometer and by analyzing one spectral band at a time. Application of the procedures is demonstrated by analyses of tonal patterns representing suspended sediment and plankton in an estuary. (Sinha-OEIS) W73-14631

RIP CURRENTS. 2. LABORATORY AND FIELD OBSERVATIONS, Liverpool Univ. (England). Tidal Inst.

For primary bibliographic entry see Field 02E. W73-14636

TURBIDITY, TRANSPARENCY AND COLOR OF WATER IN THE ESTUARY AREA (MUT-NOST', PROZRACHNOST' I TSVET VOD VZ-MOR'YA),

I. A. Ray, and K. Bondar. Available from the National Technical Informa-Available from the National Technical Informa-tion Service as AD-651-798, \$3.00 in paper copy, \$1.45 in microfiche. Naval Oceanographic Office, Washington, D.C. Report No Trans-258, 1967. Trans. from Gidrologiya ust'yevoy Oblasti Du-naya, Chapter 12, p. 326-332, 1963. 13 p, 7 fig, 2

Descriptors: \*Estuaries, \*Deltas, Coasts, Shallow water, Optical properties, Wind, Rivers, Sedimen-tation, "Turbidity, Storms, "Color. Identifiers: "Danube River, "Transparency, Wind-driven currents, USSR, Romania.

On the basis of observations conducted by various organization of USSR and Rumania the distribution of turbidity, transparency and color of water in the Danube estuary area was determined. It appears that the degree of turbidity depends upon the nearness to the distributaries of the Danube delta, the force and direction of wind, the quantity of discharged water per unit time and the velocity and mass of fluvial currents. The greatest degree of turbidity is observed during the flood period in the Danube (maximum in June). In the coastal portion of the estuary the variation of turbidity is determined not so much by the discharge of the river as by the action of wind-driven currents. Therefore the maximum values of turbidity in shallow areas are observed during strong sto The numerical values of transparency dependent upon these factors are briefly summarized, compared and charted, so as to present the spatial pattern of the distribution of transparency and color of water, as well as their variations with time and climatic conditions. (Sinha-OEIS)

A CASE STUDY OF LITTORAL DRIFT BASED ON LONG-TERM PATTERNS OF EROSION AND DEPOSITION, Johns Hopkins Univ., Baltimore, Md. Cheaspeake

J. R. Schubel, H. H. Carter, E. W. Schiemer, and

Chesapeake Science Vol 13, No 2, p 80-86, June 1972. 8 fig, 3 ref. NOAA PL 89-304, Proj. AFC-4-1.

Descriptors: \*Littoral drift, \*Coasts, \*Sediment transport, Erosion, Sedimentation, Sands, \*Estuaries, \*Deposition (Sediments), \*Chesapeake Bay. Identifiers: Near shore processes, Longshore drift. Sand transport.

A knowledge of the routes and rates of littoral drift is a prerequisite to predicting the probable effects of proposed nearshore structures on the main-tenance of a stretch of coast. The prevailing pattenance of a stretch of coast. The prevailing pat-terns of littoral drift can, at least in some cases, be more reliably established by inference from the long-term patterns of erosion and deposition than through short-term field studies of sediment transport. For an 8-mile stretch of Chesapeake Bay coast, a case study was designed to delimit the long-term patterns of erosion and accretion in order to establish the prevailing littoral drift. The routes of nearshore sediment transport inferred from the sediment budget data indicate that there is a prevailing longshore drift from north of Long Beach to just south of the cape at Flag Ponds where an eddy interrupts the sand movement. The longshore transport is reestablished south of the Ponds and extends to Cove Point. (Sinha W73-14641

WAVE AGITATION IN BAYS AND HARBORS -METHODS OF MEASUREMENT AND ANALY-

Tokai Univ., Tokyo (Japan). Coll. of Marine Science and Technology. T. Sakou.

In: Proceedings Tenth Conference on Coastal Engineering, TOKYO, September 1966. Chapter 45, Vol 2, p 97-107, 1966. 5 fig, 9 ref.

Descriptors: \*Bays, \*Harbors, Coastal engineering, Surges, Coasts, \*Waves (Water), Hawaii. Identifiers: Honolulu, \*Wave action, \*Near shore processes.

Practical and effective methods for the measurement of and the determination of the type and the mode of wave action in a semi-enclosed basin are investigated. Pressure gages and flow meters are considered as instruments abailable for such measurement. The combination and arrangement of these instruments as well as the use of power spec-tral and cross spectral analyses as the basic means of data reduction are discussed. Special attention is given to the problem of estimating the contributions from the progressive and from the standing modes of oscillation separately. Significance of such estimation on engineering planning is briefly discussed and examples are given. (Sinha - OEIS)

SHALLOW-WATER WAVES, Shell Development Co, Houston, Tex. Explora-tion and Production Research Div. J. E. Chappelear.

Journal of Geophysical Research Vol 67, No 12, p 4693-4704, November 1962. 4 fig, 1 tab, 11 ref.

Descriptors: \*Shallow water, Ocean waves, \*Waves (Water), \*Coasts. Identifiers: \*Solitary waves, Wave properties.

The physical problem is to calculate the profile and velocity components of a wave, subject to the conditions that the effects of viscosity and surface tension can be neglected. The flow is required to be steady, irrotational, and two dimensional, and the depth of the water is assumed to be small and constant. The shallow-water approximation, first proposed by Friedrichs, is employed, and two ad-ditional orders of approximation, beyond the three calculated by Keller, are obtained. The formulas describing the solitary wave are obtained as a spe-cial case, and the velocity of the solitary wave so obtained is found to agree almost exactly with the Boussinesq-Rayleigh formula c ± the square root of gd (1 + H/d), where c is the wave velocity, d is the depth, and H is the wave height. This velocity differs by no more than 2 per cent from the experimental values of Stephan and Dailey. (Sinha - OFIO) W73-14644

SALT-WATER INTRUSION IN PRINCE ED-WARD ISLAND

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch. P. A. Carr.

Canadian Journal of Earth Sciences Vol 6, No 1, p 63-74, February 1969, 9 fig. 3 tab, 15 ref.

Descriptors: \*Estuaries, \*Tides, \*Saline water in trusion, Aquifers, Density, \*Canada diffusion. Identifiers: \*Prince Edward Island.

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The numerous saline estuaries situated throughout Prince Edward Island permit high tides to carry salt water a long way inland and to penetrate the bedrock aquifer. Very little groundwater con-sumption occurs around the banks of the Eliot River estuary, yet salt water has moved into the bedrock to a depth of 185 ft. Beneath this salty water is fresh groundwater, which extends down to about 600 ft where it is underlain by salty water. The salty water in the upper 185 ft of the aquifer is not separated from the fresh groundwater by a confining stratum, but is kept in this position by the higher head of the fresh groundwater. This head maintains a dynamic equilibrium with the heavier salty water. The effect of density in maintaining the position of a fresh and salt water front is not as important as has been previously thought. (Sinha - OEIS) W73-14645

LATERAL DIFFUSION IN A TIDAL ESTUARY. dad Univ. (Iraq). Coll. of Engineering.

A. M. Alsaffar. Journal of Geophysical Research, Vol 71, No 24, p 5837-5841, December 15, 1966. 4 fig, 1 tab, 9 ref.

Descriptors: \*Estuaries, Turbulence, Diffusion, Mixing, Waste disposal, Tidal effects, \*Energy dissipation, \*California, Coasts, Tides, Path of

pollutants. Identifiers: San Francisco Bay, Lateral diffusion, \*Tidal estuaries, \*San Joaquin River estuary.

Experimental data on the lateral diffusion in a tidal Experimental data on the lateral diffusion in a tidal estuary of the San Joaquin River, near San Francisco Bay, were obtained and analyzed. The data were obtained by photographing floating particles. Richardson's 'four-thirds law' is verified by using the neighbor distribution hypothesis. The diffusion coefficient is a function of the mean separation distance and the velocity of flow. The mean separation distance and the variable diffusion to coefficient are notifically discussed in relation to coefficient are particularly discussed in relation to the rate of energy dissipation. (Sinha - OEIS)

SIZE DISTRIBUTIONS OF MINERAL GRAINS

SILE DISTRIBUTIONS OF MINERAL GRAINS SUSPENDED IN CHESAPEAKE BAY AND NEARBY COASTAL WATERS, Woods Hole Oceanographic Institution, Mass. G. C. Bond, and R. H. Meade. Chesapeake Science Vol 7, No 4, p 208-212, December 1966. 1 fig, 9 ref.

Descriptors: Sediments, \*Particle size, \*Bays, \*Deposition (Sediments), \*Coasts, \*Estuaries, Suspended load, \*Sediment transport, \*Chesapeake Bay, Litteral.
Identifiers: Cape Henry, Cape Hatteras,
Suspended matter, Mineral grains.

Recognizable mineral grains constituted 2 to 15% of the suspended matter in surface waters col-

### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

### Saline Water Conversion—Group 3A

lected in June 1965 from Chesapeake Bay and from the offshore area between Cape Henry and Cape Hatteras. In the upper bay, the mineral grain size became progressively finer in the down-bay direction. Mineral size distributions in the middle and lower bay showed little relation to those in either the upper bay or the offshore waters. Most of the mineral grains suspended in the offshore waters (considered on a weight basis) seemed to be derived from sources other than the bay effluent. (Sinha - OEIS) W73-14654

SEDIMENTS OF THE JAMES RIVER ESTUA-

RY, VIRGINIA, Virginia Inst. of Marine Science, Gloucester Point. M. M. Nichols.

Geological Society of America Memoir 133, p 169-212, 1972. 28 fig. 1 tab, 36 ref.

Descriptors: \*Estuaries, \*Sediment transport, Bottom sediments, Organic matter, \*Deposition (Sediments), Sedimentation, \*Bathymetry, Particle size, Salinity, \*Virginia.

rents. Sea level variations.

Identifiers: \*James River Estuary (Va), Tidal cur-

The James River estuary of the Chesapeake Bay region follows the course of a former river valley drowned within the last 9,000 years by the most recent rise of sea level. The floor is shaped into a central channel bordered by submerged shoals. Observations show suspended sediment is transported mainly by alternating tidal currents and secondarily by the net nontidal estuarine circulation. Transport results in a sequence of grain size distributions reflecting the mixing of two textural end members, clay and sand. Silty clay is deposited in the river and upper estuary, whereas sand occurs near the mouth. Transitional types, clayey sand and sand-silt-clay, predominate in the middle estuary. Additionally, biogenic materials, oyster shells and fecal pellets, and small amounts of residual components eroded from older deposits are mixed into the sediments by currents, waves, and organisms. Bottom sediment types vary widely according to local relief, to varying in-tensity of environmental processes, and to changing rates of supply from different sources. Deposi-tion is greatest in the middle estuary where salinity ranges from 5 to 14 parts per thousand. An elongate zone of relatively high deposition in the lower estuary corresponds to the intersection of the level of no-net-motion with the bottom. Despite substantial infilling, it is believed the estuary is maintained by the continued rise of sea level and by currents that flush part of the river-borne load through the estuary. (Sinha - OEIS)

OCEANOGRAPHIC SURVEYS OF TRAITORS COVE REVILLAGIGEDO ISLAND, ALASKA, Bureau of Commercial Fisheries, Washington,

DC D. R. McLain.

Special Scientific Report - Fisheries No 576, December 1968. 17 p, 15 fig, 2 tab, 12 ref.

Descriptors: \*Estuaries. \*Turbulence. \*Stratifica-Descriptors: "Studies, "Uniouence, Studies, etc., studies, etc., studies, etc., studies, stud

Traitors Cove is a small fiordlike estuary in southeastern Alaska. It is divided into two basins by a narrow constriction, where a reversing tidal falls forms. Four oceanographic surveys of the estuary between 1963 and 1965 showed that this tidal falls creates a region of strong turbulence and destroys the stratification of the water near it. Surface currents in the estuary are predominantly seaward on ebb tide and toward the head of the estuary on flood tide. (Sinha - OEIS) W73-14657

CIRCULATION, SALINITY AND RIVER DISCHARGE IN THE MERSEY ESTUARY, Liverpool Univ. (England). Dept. of Oceanog-

raphy. K. F. Bowden, and S. H. Sharaf El Din. Geophysical Journal. Royal Astronomical Society, Vol 10, No 4, p 383-399, Jan. 1966. 7 fig, 8 tab, 6

Descriptors: \*Estuaries, \*Mixing, \*Salinity, River flow, \*Circulation, Tides, Diffusion. Identifiers: \*Mersey Estuary (U.K.), Vertical eddy diffusion, \*River discharge.

Observations of currents and salinity in the Narrows of the Mersey estuary have been analyzed in terms of the mixing processes and the dynamics of the flow. At each of 3 stations in a section across the estuary there was a downstream flow in the upper layer and an upstream flow near the bottom, relative to the depth-mean current. Computed values of the coefficient of vertical eddy diffusion, Kz, reached a maximum of 28 sq cm/s at mid-depth at the central station. From observations of salinity in 2 sections at opposite ends of the Narrows, repeated at approximately monthly intervals throughout a year, a high correlation was found throughout a year, a man correlation was found between the properties of the salinity distribution and the river discharge into the estuary. While the salinity at the 2 sections decreased with increasing discharge, the horizontal and vertical gradients of salinity both increased. The probable change in the circulation associated with these chilative houses. circulation, associated with these salinity changes. is discussed. Variations in the tidal range had a comparatively small effect on the salinity distribu-tion. (Sinha - OEIS) W73-14658

SALINITY VARIATIONS IN THE CONNEC-TICUT RIVER,

Geological Survey, Woods Hole, Mass. R. H. Meade.

Water Resources Research Vol 2, No 3, p 567-579, 1966, 12 fig. 7 ref.

Descriptors: "Estuaries, "Salinity, "Tides, Winds, Rivers, Fresh water, Salt water, "Connecticut river, Mixing, Winds, Chlorides.
Identifiers: "Salt-wedges, River discharge, "Tidal

Salinity distributions in the lower Connecticut River, measured during the years 1934 through 1939, show the influence of at least three factors: river discharge, tide, and wind. Salinity near the mouth is rather sensitive to changes in upland mouth is rather sensitive to changes in upland discharge; discharge events recorded at a gage 101 km upstream are followed a day or two later by markedly equivalent changes in salinity at the mouth. During average or greater-than-average discharge conditions the lower river has the distange commons the lower live has the characteristics of a 'salt-wedge' estuary: the water on the bottom of the river may contain 15 parts of chloride per thousand at high tide, whereas the water in the same section of the river at low tide water in the same section of the river at low the may be almost completely fresh. The effects of winds on salinity are uncertain, but such effects can be either local or related to regional effects of ds on the tides at the river mouth. (Sinha -OEIS) W73-14659

REFRACTION OF WATER WAVES, Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.

J. A. Batties.

J. A. Battjes.

Journal of the Waterways and Harbors Division,

American Society of Civil Engineers, Vol 94, No

WW4, Proceedings paper 6206, p 437-451,

November 1968. 3 fig, 15 ref, append.

\*Refraction (Water Descriptors: Hydrodynamics, \*Ocean waves, \*Gravity waves, \*Waves (Water), Coasts. Identifiers: \*Gravity surface waves, Wave am plitudes, Wave propagation, Shoaling, Diffraction. An investigation is presented of the propagation of 3-dimensional, harmonic waves of small amplitude through water of constant depth or gradually varying depth. Within the framework of linear theory for potential flow, the results are exact for propagation over horizontal bottoms, e.g., diffraction, and approximate for propagation over shoping bottoms, e.g., refraction combined with diffraction. An expression is given for the velocity potential of 3-dimensional waves, harmonic in time. The velocity potential of 3-dimensional waves, harmonic in time. The velocity potential must fulfill the classical hydrodynamical conditions. An analysis of the resulting relationships shows that the magnitudes of phase speed and energy flux are affected by amplitude variations. The time-averaged energy flux of phase speed and cheigy into are affected by am-plitude variations. The time-averaged energy flux is directed along wave rays, regardless of am-plitude gradients along the wave crests. The ex-pressions for phase speed and energy flux do not involve wave rays; they provide the basis of a computational scheme in which the wave characteristics are com puted in grid points which have a predetermined location. The method may be an alrays. (Sinha - OEIS)
W73-14660

SOME ASPECTS OF THE OCEANOGRAPHY OF LITTLE PORT WALTER ESTUARY, BARANOF ISLAND, ALASKA, Michigan Univ., Ann Arbor. Great Lakes

Michigan Un Research Div.

Fishery Bulletin, (U. S. Fish and Wildlife Service), Vol 63, No 1, p 143-164, 1963. 27 fig, 3 tab, 10 ref.

Descriptors: "Estuaries, Fish management, Sal-mon, "Circulation, "Salinity, "Temperature, Opti-cal properties, Estuarine environment, Dissolved oxygen, Estuarine fisheries, "Alaska, "Oceanog-

Identifiers: Flushing, \*Little Port Walter (Alas), Oncorhynchus gorbuscha.

Oceanographic studies made in the spring and summer of 1959 in the estuary of Little Port Walter, Alaska are reported. These were made as Watter, Alaska are reported. I ness were made as part of a series of investigations on the biology of pink salmon, Oncorhynchus gorbuscha. Informa-tion is given on the distribution of salinity, tem-perature, transparency, and dissolved oxygen; cir-culation and flushing of the estuary and the relation of these factors to the discharge of Sashin Creek; and total water transport into and out of the estuary. The methods of studying these processes and parameters are explained. A bathymetric chart of the estuary and meteorological data are included. (Sinha-OEIS) W73-14665

### 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

APPLICATION OF FLUIDIZED BED FOR CON-TROLLING THE CONCENTRATION POLARIZATION BOUNDARY LAYER IN REVERSE OSMOSIS DESALINATION National Instrument Labs., Inc., Fredericksburg,

H. Lolachi.

H. Lolacht. Available from the National Technical Informa-tion Service as PB-219 136, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 843, March 1973, 57 p, 8 tab, 22 fig, 8 ref. OSW Contract 14-30-2909.

Descriptors: \*Desalination, \*Reverse osmosis, \*Boundary layers, \*Permeability, Reynolds number, Cellulose, \*Membranes. Identifiers: Salt rejection, Fluidized bed, Glass microbeads, Surface fouling, Water flux, Tubal reverse osmosis, \*Polarization, Cellulose acetate.

### Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3A-Saline Water Conversion

The following results have been achieved towards The following results have been achieved towards concentration polarization and fouling reduction control. Fluidized beds were compatible with reverse osmosis membranes and did not damage the active membrane surface. Application of a fluidized bed diminishes the concentration polarization to such extent that at low Reynolds number, i.e. 50 to 250, potable water better in a like the concentration of the control of the contr quality than some systems operating with turbu-lent flow was obtained. High water receoveries were obtained, for example, from a 5 ft. long tube with 3/4 in. outer diameter, 30 to 50 per cent product water recoveries were obtained at pressures ranging between 600 to 1500 psi. (OSW) W73-14377

THE EFFECTS OF POROUS AND SOLID FIL-LERS ON THE PERMEABILITY OF CELLU-LOSE ACETATE MEMBRANES, Cornell Univ., Ithaca, N.Y. School of Chemical

Engineering. P. Harriott, J. Wu, and F. Klunker.

Available from the National Technical Informa-tion Service as PB-221 315, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 846, April 1973. 28 p, 21 fig, 2 tab, 15 ref. OSW Contract 14-01-0001-2155.

Descriptors: \*Desalination, \*Reverse osmosis, Cellulose, Silica, Gels, Sands, \*Thermal conduc-tivity, \*Membranes, Porous media, Permeability, Diffusivity, Moisture content.

Identifiers: Salt permeability, Salt diffusivity, Compaction resistance, \*Fillers, Water flux, Dis-tribution coefficients, Cellulose acetate.

Several types of filled cellulose acetate membranes were prepared to determine the effect of filler properties and polymer properties on permeability of the composite materials. Casting procedures were chosen to give a dense cellulose acetate phase and a uniform distribution of filler throughout the membrane. The composite mem branes were evaluated in a reverse osmosis cell and in extraction or desorption tests at ambient conditions. Salt and water permeabilities were measured on filled and unfilled membranes of varying acetyl content. (OSW) W73-14378

PREPARATION OF HOLLOW FIBERS AND THE EVALUATION OF THEIR PROPERTIES,

Akron Univ., Ohio. Inst. of Polymer Science. E. A. Meinecke, D. V. Mehta, and S. Crume. Available from the National Technical Information Service as PB-219 395, \$1.45 in microfiche.
Office of Saline Water Research and Development
Progress Report No. 845, March 1973. 213 p, 102
fig. 14 tab, 63 ref. OSW Contract 14-01-0001-1456.

Descriptors: \*Desalination, Membranes, Cellu-Descriptors: "Desaination, membranes, Celiu-lose, "Membrane processes, "Permeability, Mechanical properties, Creep, Stress. Identifiers: "Hollow fibers, Salt rejection, Water flux, Fiber failure mechanisms, Cellulose acetate,

Melt extruder, Birefringence.

A small melt extruder was designed and constructed for the production of low flux hollow fibers from Eastern E-400-25 cellulose acetate. The screw driven extruder, equipped with special stretching and take up mechanisms, was used to produce fibers having diameters ranging from .003 to .05 inches, with a variable wall thickness to diameter ratio. Hollow fiber bundles were prepared by casting fiber ends in epoxy blocks for insertion into high pressure test cells. Hollow fibers were also produced by solution extrusion. However, solvent evaporation difficulties limited the wall thickness/diameter ratio to values too the wall thickness/diameter ratio to values too small to withstand the high pressures encountered in reverse osmosis processes. Desalination characteristics of unstretched and stretched membranes were studied as a function of membrane thickness. Fick's law of transport was applicable not only to the flux characteristics of unstretched membranes, as expected, but also to those of stretched membranes. The applicability of time-temperature superposition to the ultimate elongation of cellulose acetate was also established in these studies. Model studies were also made to determine the in-fluence of fiber geometry to the various mechanisms of fiber failure. (OSW) W73-14379

GUIDE TO OPERATION AND MAINTENANCE OF THE AUTOMATIC PARTICLE SIZE ANALYZER,

Rocketdyne, Canoga Park, Calif. G. R. Schneider.

Available from the National Technical Informa-tion Service as PB-220 228, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 839, March 1973. 43 p, 9 fig, 1 append, 5 tab. OSW Contract 14-30-3000.

Descriptors: Particle size, Ice, Desalination, Freezing, Automation, Instrumentation. Identifiers: \*Particle size analyzer.

An Automatic Particle Size Analyzer (APSA) for An Automatic Particle Size Analyzer (APSA) for analyzing the particle size distribution in a freeze crystallizer is described. The system contains the following electronic and optical instruments: (1) a particle sensor, (2) an amplifier/power supply, (3) a pulse converter, (4) a pulse height analyzer, and (5) a serial printer. The operation, maintenance, and data reduction from use of the APSA are described. (OSW) W73-14380

REACTIONS AND TRANSPORT PHENOMENA

AT SURFACES, Oak Ridge National Lab., Tenn. F. A. Posey, E. G. Bohlmann, S. S. Misra, D. V.

Subrahmanyam, and F. Nelson.

Available from National Technical Information
Service as PB-220 644, \$1.45 microfiche. Office of Saline Water Research and Development Progress Report No. 852, May 1973. 70 p, 30 fig, 54 ref, 4 tab. OSW contract 14-01-0001-937.

Descriptors: \*Titanium, \*Corrosion, \*Pitting (Corrosion), Saline water, \*Desalination, Electrodes, Reactions, Kinetics, \*Surfaces.

Identifiers: Crevice Corrosion, Porous Electrodes, Tubular Electrodes, Valve Metals, Chronopoten-tiometry, Silver-Silver Chloride System.

A number of topics describe various reactions and transport phenomena at surfaces which are of potential interest in desalination processes. These topics are: kinetics of pitting attack of Titanium in Chloride Solutions; pitting of Titanium Alloys in Saline Waters; kinetics of Initiation of Crevice Corrosion of Titanium; effect of Flow Rate on Ef-ficiency of Oxidation-Reduction Reactions in Porous and Tubular Electrodes; rectifying Properties of Valve Metals in a One-Compartment Electrolysis Cell; chronopotentiometry of the Ag-AgCl System and Analysis for the Chloride Ion; and influence of Inert Electrolytes Chronopotentiometric Constants. (OSW). W73-14381

RESEARCH AND DEVELOPMENT OF COM-POSITE MEMBRANE TECHNOLOGY, Gulf Environmental Systems Co., San Diego,

R. L. Riley, C. E. Milstead, W. J. Wrasidlo, R. L.

Grabowsky, and G. R. Hightower. Available from the National Technical Information Service as PB-220 218, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 851, May 1973. 188 p, 32 fig, 57 tab. OSW contract 14-30-3016.

Descriptors: \*Desalination, \*Membranes, \*Reverse osmosis, Semipermeable membranes, Permselective Membranes, \*Permeability, Thin

films, Sea water, Saline water, Salinity, Ocean water, Potable water, Polymers.

water, rotatie water, rotatiers. Identifiers: "Composite membranes, Ultra-thin films, Barrier materials, Polyelectrolyte mem-brane systems, Ultrafiltration membranes, Block polymers, Thin-film composites.

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Recent advances in the continuing development of the composite membrane have made it possible to the composite membrane have made it possible to produce potable water from seawater in a single-stage system at water recoveries in excess of 50%. Stable long-term water fluxes of 25 gal/ft2-day and sodium chloride rejections of greater than 99.5% have been attained with seawater at an applied pressure of 1500 psi; water fluxes at 15 gal/ft2-day have been attained at 1000 psi applied pressure with greater than 99% sodium chloride rejection. Large-scale continuous production of composite membrane has been attained on the prototype casting machine. This achievement, combined casting machine. This achievement, combined with the excellent seawater performance of composite spiral-wound modules, demonstrates a sig-nificant advance toward the practical application of the thin film composite membrane. Block copolymers and terpolymers of completely and permanently charged cationic and anionic sequences containing various block combinations have been prepared by block polymerization of 2-vinyl-pyridine (2VP), trimethylsilylemethacrylate (TSM) and styrene (SI) monomers, followed by complete quaternization of 2VP sequences, complete hydrolysis of the TSM sequence, and dehydrohalogenation. Desalination studies on dynamically formed membranes of these block copolymers are reported. The results obtained using matrix polymerization as a preparative site spiral-wound modules, demonstrates a sigusing matrix polymerization as a preparative method have shown that polyelectrolyte complex membranes are effective in the separation of low molecular weight polymeric substrates in ultrafil-tration. (OSW).

HYPERFILTRATION IN POLYELECTROLYTE

MEMBRANES, Weizmann Inst. of Science, Rehovot (Israel).

D. Vofsi, and O. Keden. Available from the National Technical Information Service as PB-220 221 \$1.45 in microfiche. Of-fice of Saline Water Research and Development Progress Report No. 850, May 1973. 158 p, 18 fig, 15 tab. OSW contract 14-01-0001-961.

Descriptors: \*Desalination, \*Membranes, \*Reverse osmosis, Osmosis, \*Permeability, osmosis, Osmosis, rmeable membranes, Semipermeable Separation Semipermeable membranes, Separation techniques, Permselective membranes, Thin films. Identifiers: "Hyperfiltration, Streaming potential, Charged membranes, Mosaic membranes, "Polyelectrolyte membranes, Irradiation grafted charged membranes.

Various topics dealing with fundamental aspects of transport through reverse osmosis membranes are included in two sections. I. Hyperfiltration in polyelectrolyte membranes: analysis of the hyper-filtration streaming potential; hyperfiltration by charged membranes; II. Streaming potential mea-surements; characterization of charged mem-branes during hyperfiltration; permeability mosaic membranes; hyperfiltration by dynamically formed polyelectrolyte membranes on partially cured cellulose acetate; and preparation and reverse osmosis performance of irradiation grafted charged membranes. II. The state and transport of water in membranes: the state of water in membranes; and the hyperfiltration streaming potential as a probe of water structure in membranes. (OSW) polyelectrolyte membranes; analysis of the hyper-W73-14383

RESEARCH AND DEVELOPMENT OF NEW AND IMPROVED CELLULOSE ESTER MEM-BRANES.

Envirogenics Systems El Monte, Calif. D. L. Hoernschemeyer, C. W. Saltonstall, O. S. Schaeffler, and A. J. Secchi.

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

#### Water Yield Improvement—Group 3B

Available from the National Technical Informa-tion Service as PB-220 435, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 849, May 1973, 52 p, 12 fig, 18 tab. OSW contract 14-01-0001-2205.

Descriptors: \*Reverse Osmosis, \*Membranes, \*Desalination, Permselective membranes, Separation techniques, Brackish water, Membrane processes, Permeability, Osmosis.

Identifiers: Cellulose acetate blend, Cellulose acetate methacrylate, Membrane voids, Crosslinking, Swelling agents, Annealing temperature.

Modified cellulose acetate blend membranes gave an initial flux of 35 gfd with 97% salt rejection, with a flux-decline parameter of 0.05, at 300 psi with 1% sodium sulfate feed. However, these modified blend membranes contained small voids, which were found to require at resource of 800 which were found to rupture at pressures of 800 psi or larger. Crosslinked Cellulose acetate methacrylate (CAM) membranes gave an initial flux of 43 gfd and a salt rejection of 98.8% at 300 psi with 1% sodium sulfate feed. A comprehensive rogram to eliminate voids from CAM membranes (thus increasing their reliability at higher pressure) by a solubility parameter approach to selecting a solvent or nonsolvent different than acetone, isoprophy alcohol and water was unsuccessful. However, the addition of magnesium perchlorate to the casting solutions eliminated voids, and im-proved the crosslinkshifty of CAM membranes. The extent of crosslinking was still insufficient to provide a flux stability superior to that of blend membranes at 1500 psi. (OSW). W73-14384

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CONCEPTUAL DESIGN AND COST ESTIMATE 2.5 MGD DIRECT CONTACT CONDENSATION
MULTISTAGE FLASH DESALINATION MULTISTAGE

PLANT, M. E. Marwede, P. J. Schroeder, Al Kohl, and T. T. Shimazaki.

Available from the National Technical Informa-tion Service as PB-220 643, \$5.45 in paper copy, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 821, January 1973, 78 p, 18 fig, 12 ref. OSW contract 14-01-001-1286.

Descriptors: \*Design, \*Cost analysis, \*Condensation, Resins, Plastics, \*Heat exchanges, \*Distillation, \*Desalination.

The conceptual design and costs of a 2.5 MGD Direct Contact Condensation Multistage Flash Desalination Plant (DCC-MSF) were determined. The study indicated that the process is competitive with other processes such as VTE upflow or VTE downflow plants. Product water was estimated to cost \$0.86 per 1000 gallons. Further testing of plant components is recommended. (OSW) W73-14385

RESEARCH ON IMPROVED REVERSE OSMO-SIS MEMBRANES, Gulf Environmental Systems Co., San Diego,

Catt.
C. E. Milstead, G. R. Hightower, C. R. Lyons, K.
J. Mysels, and R. L. Riley.
Available from the National Technical Information Service as PB-220 219, \$1.45 in microfiche.
Office of Saline Water Research and Development
Progress Report No. 847, April 1973. 119 p, 21 fig,
48 tab. OSW contract 14-30-2609.

Descriptors: \*Reverse Osmosis, \*Membranes, Semipermeable membranes, \*Desalination, Descriptors: "Reverse Osmosis, "Membranes, semipermeable membranes, "Desalination, Separation techniques, Saline water, Membrane processes, Permselective membranes. Identifiers: "Composite membranes, "Ultrathin membranes, Spiral wound module, Compaction, Wet-dry stability, Polyacrylic polysulfone membranes."

Four principal areas of research and development were investigated. The primary effort was directed toward an investigation of the cause of aging of the cellulose nitrate-cellulose acetate (CN-CA) support and possible solutions for the effect of this aging on the physical and transport properties of the thin-film composite membrane. The second area of investigation involved the development of the composite membrane spiral-wound module. The wet-dry stability of the composite membrane modules was studied in an effort to develop a module capable of undergoing repeated wet and dry cycles without a loss in water flux or an increase in salt permeability. Cross-linking of the crease in salt permeability. Cross-linking of the porous support prior to application of the thin film was also examined in an effort to reduce the flux decline after pressurization and subsequent drying at elevated temperatures. The third area of research dealt with the long-term behavior of assymmetric CA membranes, including a rheological analysis of the effect of annealing and compaction on water transport and an evaluation of the effect of pressure acting to compress the intermediate layers of the membrane. The fourth area of research consisted of further characterization of composite polyacrylic acid-polysulfone (PAA-PS) membrane performance in mixed salt systems, as well as with various inorganic and organic solutes. (OSW) W73-14386

HUMIDIFICATION-DEHUMIDIFICATION PROCESS (SOLAR DISTILLATION),

PROCESS (SOLAR DISTILLATION), Yugoslav Academy of Sciences and Arts, Dubrov-nik. Inst. for Marine Corrosion and Desalination. H. Ivekovic, S. Lendic, and S. Lasic. Available from National Technical Information Service as PB-219 256, \$1.45 in microfiche. Office

of Saline Water Research and Development Progress Report No. 841, March 1973. 28 p, 16 tab, 7 fig. OSW contract 14-01-0001-1427.

Descriptors: \*Desalination, Solar stills, \*Solar distillation, \*Distillation, \*Evaporators, Humidity, Saline water. Identifiers: \*Dehumidification.

An evaporator was constructed in which warm An evaporator was constructed in which warm saline water flowed downward in the capillaries of hydrophilic gauze sheets. Countercurrent to the saline water flow, warm air flowed along the evaporator through spaces between the gauze sheets thereby saturating it with water vapor. The influence of the flow rate and temperature of both the saline water and air on the amount of water ob-tained was studied. Eighty experiments were car-ried out. The highest production of distilled water was obtained with a warm saline water flow rate of 11.7 1/h and a temperature of 75C, when combined with air flow rate of 16 m3/h at 110C. (OSW) W73-14388

#### 3B. Water Yield Improvement

EFFICIENCY OF WATER USE AS IN-FLUENCED BY MICROMETEOROLOGICAL AND PHYSIOLOGICAL PROCESSES, Kansas Water Resources Research Inst., Manhat-

For primary bibliographic entry see Field 02D. W73-14206

ANTITRANSPIRANTS: A POSSIBLE ALTERNA-TIVE TO THE ERADICATION OF SALTCEDAR THICKETS. Arizona Univ., Tucson. Dept. of Watershed

Anzona Univ., Tucson. Dept. of watersnea Management. R. S. Cunningham, and D. B. Thorud. In: Proceedings, 16th Annual Water Conference, Las Cruces, New Mexico Water Resources Research Institute, March 25-26, 1971. p 101-109, 2 fig. 1 tab, 14 ref. OWRR A-018-ARIZ (4). 14-31-0001-3203.

Descriptors: \*Phreatophytes, \*Transpiration control, Soil-water-plant relationships, Water conser-

Controversy concerning the eradication of salt-cedar for water salvage and flood control indicates that a management alternative may be desirable. The application of antitranspirants to saltcedar may provide such an alternative. The antitranspirants 8-HQS (0.01M) and MDSA (350 ppm) were sprayed on the foliage of potted saltcedar in a greenhouse at Tucson. The transpiration rates were 29 to 47% below control for 5 to 13 days after single applications, and following a retreatment, 27 to 35% less than control for an additional 15 to 31 days. Consequently, plants receiving two treatments transpired less than control for a minimum of three weeks. These are considered important ments transpired less than control for a minimum of three weeks. These are considered important treatment effects. Conceivably, rainfall could diminish treatment effectiveness. Simulated rain was sprayed on plants in the greenhouse on the first, second or fourth day after treatment with antitranspirants. These studies were inconclusive. Generally, rain did not change the magnitude of transpiration reduction following treatment with antitranspirants. Likewise, rain did not cause important changes in the duration of transpiration reduction in two tests. In another test, however, plants receiving rain transpired less than control reduction in two tests. In another test, nowever, plants receiving rain transpired less than control for three days, while plants receiving no rain transpired less than control for 15 to 31 days. A rain-no rain difference of this magnitude could be important in an operational treatment program. The tant in an operational treatment program. Ine growth, color and form of plants treated with one and two applications of 8-HQS and MDSA were not noticeably different from control during or after the experiments. (See also W73-14224) W73-14226

ECOLOGICAL RESPONSE OF THE AUSTRALIAN NATIVE SPECIES ACACIA HAR-POPHYLLA AND A TRIPLEX NUMMULARIA TO SOIL SALINITY: EFFECTS ON WATER CONTENT, LEAF AREA, AND TRANSPIRA-

TION RATE,
Commonwealth Scientific and Industrial Research
Organization, St. Lucia (Australia). Cunningham

For primary bibliographic entry see Field 03C. W73-14472

EFFECT OF SODIUM CHLORIDE SALINITY ON THE WATER BALANCE OF ATRIPLEX HALIMUS,

Hebrew Univ., Jerusalem (Israel). Dept. of Botany. For primary bibliographic entry see Field 03C. W73-14477

SNOW AMOUNT IN RELATION TO STREAM-

FLOW AND HERBAGE PRODUCTION IN WESTERN COLORADO, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.

Journal of Range Management, Vol 26, No 1, p 32-34. Jan. 1973. 3 fig, 1 tab, 3 ref.

Descriptors: "Snowpacks, "Streamflow, "Vegeta-tion effects, "Productivity, "Cloud seeding, Grasses, Grazing, "Colorado, Precipitation (At-mospheric), Snow cover, Runoff, Snow surveys. Identifiers: Black Mesa Experimental Range

Black Mesa Experimental Range, located west of Gunnison, Colorado, was used to determine the in-Gunnison, Colorado, was used to determine the influence of augmenting the mountain snowpack by cloud seeding. Data were analyzed statistically to define quantitatively the relationship of peak snowpack to hydrologic characteristics and berbage production. Results indicated that increasing the snow precipitation input by 10 percent would lengthen the duration of snow cover less than 2 days; therefore it would have little, if any, im-

#### Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3B-Water Yield Improvement

mediate effect on the productivity and use of grasslands. (BahrenArizona) W73-14479

HIGH YIELD FROM THE BULL RUN

WATERSHED, British Columbia Dept. of Municipal Affairs, Vic-toria. Environmental Planning and Management

For primary bibliographic entry see Field 02A. W73-14687

#### 3C. Use of Water of Impaired Quality

REPORT ON MAKEUP WATER FOR THE UPPER CANYON LAKES, LUBBOCK, TEXAS. Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 05G. W73-14236

ECOLOGICAL RESPONSE OF THE AUSTRALIAN NATIVE SPECIES ACACIA HARPOPHYLLA AND A TRIPLEX NUMMULARIA TO SOIL SALINITY: EFFECTS ON WATER CONTENT, LEAF AREA, AND TRANSPIRA-

TION RATE, Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Cunningham

C. T. Gates

Australian Journal of Botany, Vol 20, No 3, p 261-272, Dec. 1972. 6 fig, 4 tab, 20 ref.

Descriptors: \*Moisture stress, \*Transpiration, \*Leaves, \*Australia, Saline soils, Saline water, Wilting. Identifiers: \*Acacia, \*Saltbush.

Described are water relations in response to saliniy of the legume Acacia harpophylla (brigalow) and of chenopod Atriplex nummularia (old man saltbush), as well as the response of the latter to associated water stress caused by climatic-geographic locations. Both species tolerated salinities up to and beyond sea water concentration under high insolation stress. The effects of leaf area and leaf number for the two species were different, but both benefited from high salinity in the conservation of their water supply with water content of their tissues being higher, especially that of the laminae. Both showed a reduction in the transpiration per unit of leaf area. A. nummularia plants subjected to water shortage in saline substrates had higher lamina water levels, along with a lesser degree of tissue injury both during wilting and upon recovery. Potassium increased tissue hydra-tion more than sodium in A. harpophylla. (Bahre-Arizona)

THE EFFECT OF GRADUAL LEACHING ON THE GROWTH AND YIELD OF SUGAR CANE

IN SALINE SOILS, M. H. El-Gibaly, and M. Goumah. United Arab Republic Journal of Soil Science, Vol 11, No 1, p 27-37. 1971. 8 fig, 10 ref.

Descriptors: \*Sugarcane, \*Saline soils, \*Irrigation effects, Crop response, \*Leaching, Salinity, \*Crop production.
Identifiers: \*United Arab Republic.

Sugarcane is the main crop of the southernmost part of the UAR, where aridity and salinity are manifest in many areas. Observations were made on the tolerance of sugarcane when planted in soils of different salt levels and nature. Irrigation every other 10 days dilutes the soil solution and lessens the concentration of salts around the buds and plant roots. A drum culture technique experiment was used to study the effect of integrated leaching on growth and yield of 2 main varieties of sugar-cane: CO.310 and CO.413. Tap water was used for irrigation during growth, with the amount of irriga-tion water slightly above water saturation percent-age of the soil to allow relatively little salt leaching from the root zone. This permitted a gradual slow improvement of salinity. Results show that both varieties can grow successfully in saline soil of surprovement of sannity. Seasits show that both varieties can grow successfully in saline soil of 0.14 percent salinity providing the gradual leaching of salts. A yield of about 50 to 60 percent and 30-40 percent of the non-saline condition can be obtained from both varieties if the initial soil salinity. is 1 percent. CO.413 is more tolerant to initial shocks of salinity than CO.310. Slight salinity increases the sucrose percentage in sugarcane. (Bahre-Arizona) W73-14473

EFFECT OF SODIUM CHLORIDE SALINITY ON THE WATER BALANCE OF ATRIPLEX HALIMUS, Hebrew Univ., Jerusalem (Israel). Dept. of

A. Kaplan, and J. Gale

Australian Journal of Biological Sciences, Vol 25, No 5, p 895-903, Oct. 1972. 5 fig, 3 tab, 20 ref.

Descriptors: \*Water balance, \*Salinity, \*Sodium chloride, Salt tolerance, Plant physiology, Transpiration, Water loss, Leaves, Turgidity, Hydraulic conductivity, Transpiration control, Halophytes, Evaporation, Photosynthesis, Plant growth, \*Aus-Identifiers: \*Saltbush

Sodium chloride was found to improve the water balance of A. halimus plants under conditions of high evaporative demand. Plants grown in salinized culture solutions improved, with higher values of turgor pressure and percentage satura-tion value compared with plants grown in the contion value compared with plants grown in the con-trol solutions. A constant water potential gradient was maintained between culture solution and the leaf of plants grown in saline culture solutions whose osmotic potential did not exceed -5 bars. Hydraulic conductivity of the root system appeared to have been impaired by salinity. Im-proved water balance of plants exposed to salinity could be ascribed to a reduction of transpiration. Improving plant water balance by reducing water loss from leaves so as to only slightly reduce photosynthesis per unit leaf area can be accomplished by increasing leaf turgor which leads in turn to a larger leaf area. The mesophyll resistance factor to the measured transpiration-photosynthesis ratio is discussed. (Bahre-Arizona) W73-14477

HAZARDS ASSOCIATED WITH THE USE OF CHLORINATED OXIDATION POND EF-FLUENTS FOR IRRIGATION, Technion - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 05D. W73-14480

EFFECT OF WASTE WATER FROM THE ASTRAKHAN' CELLULOSE AND PASTEBOARD COMBINE ON SOIL PROPERTIES (VLIYANIYE STOCHNYKH VOD ASTRAKHANSKOGO TSELLYULOZNO-KARTONNOGO KOMBINATA NA SVOYSTVA POCHV), For primary bibliographic entry see Field 05D. W73-14601

DESCRIPTION OF WATER-SALT RELATIONS
OF SOME SOILS IN CENTRAL CISCAUCASIA
FROM LYSIMETER EXPERIMENTAL DATA
(KHARAKTERISTIKA VODNO-SOLEVOGO
REZHIMA NEKOTORYKH POCHV TSENTRAL'NOGO PREDKAVKAZ'YA PO DANNYM
LIZIMETRICHESKIKH OPYTOV),
For primary bibliographic entry see Field 02G.
W73-14605 DESCRIPTION OF WATER-SALT RELATIONS

SEWAGE EFFLUENT AND SLUDGE MAKE POSSIBLE REVEGETATION OF STRIP MINE SPOIL BANKS Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 05E.

REVEGETATION OF STRIP MINE SPOIL BANKS WITH SEWAGE EFFLUENT AND SLUDGE, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 05E. W73-14613

#### 3D. Conservation in Domestic and Municipal Use

FUTURE MUNICIPAL AND INDUSTRIAL WATER REQUIREMENTS IN THE QU'AP-PELLE RIVER BASIN. Regina. Investigation and Planning Branch.
For primary bibliographic entry see Field 06D. For primary W73-14231

WATER DISTRIBUTION AND WASTEWATER COLLECTION SYSTEMS IN FORSYTH COUNTY, NORTH CAROLINA WITH URBAN DEVELOPMENT FORECASTS: 1968-1978-2010. City-County Planning Board, Winston-Salem, For primary bibliographic entry see Field 05D. W73-14233

LANCASTER COUNTY. PENNSYLVANIA. COMPREHENSIVE SEWERAGE PLAN. Huth Engineers, Inc., Lancaster, Pa. For primary bibliographic entry see Field 05G. W73-14234

THE ROLE OF URBAN ENGINEERING IN THE NATIONAL WATER POLICY ASSESSMENT, National Water Commission, Arlington, Va. Engineering and Environmental Sciences Div. For primary bibliographic entry see Field 06B. W73-14235

WATER QUALITY MANGEMENT PLAN FOR ALAMEDA CREEK WATERSHED ABOVE Brown and Caldwell, San Francisco, Calif. For primary bibliographic entry see Field 05G. W73-14237

SHORELINE ANALYSIS OF THE CITY OF SARASOTA. Smally, Wellford and Nalven, Sarasota, Fla For primary bibliographic entry see Field 06B. W73-14239

CITY OF ESCONDIDO AND VISTA IRRIGA-TION DISTRICT FEASIBILITY STUDY OF JOINT FILTRATION PROGRAM. Montgomery (James M.), Inc., La Jolla, Calif. For primary bibliographic entry see Field 05F. W73-14240

COMPREHENSIVE AREAWIDE WATER-AREAWIDE COMPREHENSIVE WALER-SEWER PLAN, PART 2, PHASE I, 1970-1995, BREVARD COUNTY, FLORIDA. Brevard Engineering Co., Cape Canaveral, Fla. For primary bibliographic entry see Field 05G.

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Domestic and Municipal Use—Group 3D

URBAN SYSTEMS ENGINEERING DEMON-STRATION PROGRAM. VOLUME V. CAPITAL IMPROVEMENTS PROGRAM, Diversified Consultants, Inc., Jackson, Miss. For primary bibliographic entry see Field 05G. W73-14242.

AMARILLO, TEXAS: REPORT ON WATER DISTRIBUTION SYSTEM, 1967. Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 06D. W73-14248.

PROGRESS ON GEOLOGIC-TERRAIN
MAPPING FOR LAND-USE PLANNING IN THE
TUCSON AREA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W73-14348

MUNICIPAL EVALUATION OF REGIONAL WATER QUALITY MANAGEMENT PROPOSALS,
Resources for the Future, Inc., Washington, D.C. For primary bibliographic entry see Field 05G. W73-14461

FLOOD CONTROL REPORT, CASA GRANDE, ARIZONA, 1973. Henningson, Durham and Richardson, Inc., Phoenix, Ariz. For primary bibliographic entry see Field 04A. W73-14476

RIVERSIDE'S GROUND WATER PUMPING SYSTEM. FMC Corp., Los Angeles, Calif. Peerless Pump Div. For primary bibliographic entry see Field 04B. W73-14478

A COMPARISON OF URBAN WATER USE IN AUSTRALIA AND THE U.S., Swinburne Coll. of Tech., Hawthorn (Australia). For primary bibliographic entry see Field 06D.

MIDDLETOWN STREAMBELT REPORT. Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 04D. W73-1448.

A PRELIMINARY BASELINE STUDY OF ROBERTS AND STURGEON BANKS, British Columbia Univ., Vancouver. Westwater Research Centre. For primary bibliographic entry see Field 05A. W73-14486

F

A PRELIMINARY WATER QUALITY SURVEY OF THE LOWER FRASER RIVER SYSTEM, British Columbia Univ., Vancouver. Westwater Research Centre. For primary bibliographic entry see Field 05A. W73-14487

SKETCH REGIONAL WATER AND SEWER PLAN.
Neuse River Regional Planning and Development

Council, New Bern. N.C.

Available from the National Technical Information Service as PB-214 015; \$10.00 in paper copy, \$1.45 in microfiche. June 1972. 157 p, 20 maps. NCP-146 NM-7. Descriptors: "Planning, "Water supply, \*Sewerage, Coordination, Financing, Regional development, Urbanization, Water demands, \*North Carolina, Census, \*Regional analysis. Identifiers: Utility systems extension, \*Neuse River (NC)

Basically a planning prospectus for water supply and wastewater disposal systems in the nine country Region P in eastern North Carolina, this report gives a general description of the region including population and economic analyses, outlines the basic water resources needs, presents a county-by-county inventory of existing and proposed water and sewer systems, and offers general recommendations for future planning. The focus of many of the recommendations is on a 'regional planning concept' in which several small systems would be consolidated or interconnected and county authorities would be created to coordinate water and sewer system planning and implementation. On the other hand, since much of the region is quite rural, recommendations also include the use of Farmer's Home Administration grants for small water supply systems and use of better practices in controlling and locating septic tanks. Municipal and county authority for financing and constructing water and sewer facilities is discussed. (Elfers-North Carolina)

STUDY DESIGN FOR A REGIONAL SEWER AND WATER PLAN.

Cuyahoga County Regional Planning Commission, Cleveland, Ohio.

August 1971. 35 p, 2 fig. HUD Ohio P-258-20.

Descriptors: \*Planning, Coordination, Water distribution (App\*\*d), Waste water disposal, Storm drains, \*Ohio, \*Regional analysis, Social participation, Water supply. Identifiers: \*Citizen participation, Capital improvements program, Utility extension, \*Cayahoga County (Ohio), Advisory committees.

The role of the Cuyahoga County Regional Planning Commission in developing plans for water distribution and waste water collection is outlined. Emphasis is on the relationship of Commission activities to those of several other agencies responsible for utility construction and planning. Goals and objectives for the County, sewerage planning, water supply planning, and storm drainage planning are discussed. Key sections of the report are those covering the implementation of the plans, including a capital improvements program, the integration of plans from several agencies, and citizen participation in the planning process, particularly via advisory committees and public meetings. Preliminary estimates for staging and cost breakdown and a tentative time schedule are provided. (Elfers-North W73-1489)

LANCASTER COUNTY PLANNING COMMIS-SION: STORM DRAINAGE STUDY. Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 08B. W73-14490

FLOOD HAZARD STUDY. Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga. For primary bibliographic entry see Field 06F. W73-14491

WATER, SEWER, AND STORM DRAIN STUDY, UTAH, VOLUME I: BACKGROUND AND INVENTORY. Despain (I. Dale) and Associates, Provo, Utah. For primary bibliographic entry see Field 05D. W73-14492 WATER, SEWER AND STORM DRAIN STUDY, UTAH COUNTY, UTAH: VOLUME II, PLAN REPORT. Despain (I. Dale) and Associates, Provo, Utah. For primary bibliographic entry see Field 05D. W73-14493

REPORT ON HALF MOON LAKE. Half Moon Lake Restoration Committee, Eau Claire, Wis. For primary bibliographic entry see Field 05G. W73-14494

DES PLAINES RIVER VALLEY: GOALS, POLI-CIES, AND RECOMMENDATIONS. Des Plaines River Valley Comprehensive Plan Steering Committee, Ill. For primary bibliographic entry see Field 06F. W73-14495

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM. Tulare County Planning Dept., Visalia, Calif. For primary bibliographic entry see Field 05G. W73-14497

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM--PART II. Tulare County Planning Dept., Visalia, Calif. For primary bibliographic entry see Field 05G.

WATER RESOURCES OF MIDDLE GEORGIA. Briley, Wild and Associates, Daytona Beach, Fla. For primary bibliographic entry see Field 06D. W73-1440.

MASTER PLAN FOR STORM DRAINAGE: FORT WAYNE-NEW HAVEN-ALLEN COUNTY METROPOLITAN AREA. Schnelker (Philip L.), Inc., Fort Wayne, Ind. For primary bibliographic entry see Field 06B. W73-14500

AMARILLO, TEXAS: REPORT ON SANITARY SEWERAGE AND SEWAGE TREATMENT, 1967. Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 05D. W73-14501

REALITIES OF URBAN WATER RESOURCES OPERATING PERSPECTIVE, Washington Suburban Sanitary Commission, Hyattsville, Md.
R. J. McLeod.
Paper presented at American Society of Civil Engineers, Annual Water Resources Meeting, Washington, D.C., January 29-Feb. 2, 1973. 8 p.

Descriptors: Water resources development, \*Water supply development, \*Water policy, \*Water distribution (Applied), Water delivery, Water management (Applied), Planning, Forecasting, Water allocation (Policy), \*Political aspects.

Many of the problems of water supply utilities are the result of political planning and policy decisions. In carrying out the political decisions, problems arise, and the complaints of the public are directed toward the utility, not the politicians. One problem is that planning and policy processes are not totally accurate. Planning for an expected growth of a given population with a certain distribution may prove to be inadequate, causing either shortages, or an excess capacity. With the change in selected officials can come changes in the goals of local government and, hence, a change in policy for the utility to follow. Another problem

#### Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3D—Conservation in Domestic and Municipal Use

can be the lack of cooperation of different levels of government. While some water resource projects may require only local support, other projects may require regional, state, or federal cooperation. Slow action on the part of a governmental unit can bring many problems to the local willing the company of the control o utility. Lack of financial support can cause further problems. Money is sometimes promised, but not supplied. Wastewater treatment facilities suffer similar problems. Additional problems exist in knowing what levels of water quality will be required in the future, and how municipal wastewater treatment will fit in with other forms of pollution--such as erosion, urban runoff, and agricul-tural runoff. (Poertner) W73-14614

WATER RESOURCES IN SANTA CLARA COUNTY: A PLAN FOR CONSERVATION,

Prepared for Santa Clara County Association of Resource Conservation Districts and South Santa Clara Valley Water Conservation District, 1973. 59 p, 9 fig, 13 tab, 53 ref.

Descriptors: \*Water management, \*Conservation, Coordination, Water resources development, Administration, Water supply, Sewerage, Water quality, Recreation, Urbanization, \*Planning, California Identifiers: \*Santa Clara County (Calif), County-

wide planning, Public participation

Santa Clara County is an area of 1300 square miles, 60% of which is in hills and mountains, con-taining 1.1 million people and the fourth largest city in California. Since water resources management is a total system approach, the county should take the initiative in providing integrated, countywide water resources development and conservation. Such integrated management is seen to include (1) water supply, distribution, and use, (2) sewage collection, treatment, and disposal, (3) storm and flood waters, (4) water storage, including groundwater storage, (5) water quality, (6) the reclamation and reuse of wastewater, (7) relation-ships to other planning sectors such as land use, health and safety, recreation, and open space, and (8) institutions and intergovernmental relations. Each of these topics is discussed with the emphasis often on agencies involved, planning interrela-tionships, public attitudes and goals, or socioeconomic aspects. A very detailed outline is presented of proposed goals and policies for management of water resources in the county. Polmanagement of water resources in the county. Policies include such topics as future growth, consolidation of governmental authority, wetlands, water supply sources, water quality, and public participation. (Elfers-North Carolina) W73-14675

RIVERFRONT DEVELOPMENT PLAN, CON-NECTICUT RIVER, SPRINGFIELD, MAS-Springfield Planning Dept., Mass.

January, 1973. 16 p, 6 fig, append.

Descriptors: \*Recreation, \*Connecticut River, \*Massachusetts, \*Planning, Parks, Aesthetics, Urban renewal, Water quality, Environmental effects, Land use, Access routes.
Identifiers: \*Waterfront planning, Esplanade,

\*Springfield (Mass).

The City of Springfield has historically depended on the Connecticut River for transportation and commerce, but at present much of the urban waterfront is either unused or deteriorating. However, with the new interest in water quality and environmental quality there is a great opportunity to make the river a significant asset to the metropolitan area again. Intended to establish a general framework for planning and development of the waterfront, this study consists of basic goals

and policies and more specific proposals for development in six different waterfront areas. The goals include the achievement of a 'B' water qualiy classification for the entire stretch of the river within the metropolitan area, the improvement of public access to the waterfront, the acquisition and provision of recreation facilities all along the waterfront, and the enhancement of the scen uality of the waterfront. One key concept to achieve these goals is the proposal of an esplanade, or a broad walkway, to follow the river and connect various public and recreational areas. Each of six planning areas are described in more detail, outlining specific recreation projects and land use locations. (Elfers-North Carolina)

RIVERBANKS IMPROVEMENT PROGRAM, (BROOME AND TIOGA COUNTIES, N.Y.). Broome County Planning Dept., Binghamton, N.Y.; and Southern Tier East Regional Planning Board, Binghamton, N.Y.

February, 1972. 20 p, 6 fig, 3 append.

Descriptors: \*Planning, \*Recreation, \*Flood plains, \*Parks, Environmental effects, Water quality, Rivers, Urbanization, Coordination, quality, Riv Identifiers: \*Riverbanks, Open Susquehanna River, \*Binghamton (N.Y.). Identifiers:

A summary is presented of the Riverbanks Pro-gram being carried out by the counties of Broome and Tioga covering approximately 120 miles of riverbank areas. The main river involved is the Susquehanna but four other streams, the Chenango, Delaware, Otselic, and Tioughnioga, also flow through the two-county region. The riverbanks and valleys are significant recreational and aesthetic resources in the region and are threatened by rapid urbanization, especially in the Binghamton metropolitan area. Problems include Binghamton metropolitan area. Problems include loss of open space, development on floodplains, deteriorating water quality, and changing ground-water levels. The Riverbanks Program is based on abundant data including Army Corps of Engineers reports, state and federal funding, and strong local support. Some of the policies included in the Program are: (1) key feature of the regional open space plan should be water and riverbank recreation; (2) the county governments should take the lead in developing the recreation potential; (3) large areas of riverbanks should be placed in public ownership: (4) land use standards and consulting the recreation of the placed in leading the placed in subsidiary should be placed in leading the standards and consulting the placed in leading the standards and consulting the standards and public ownership; (4) land use standards and controls should be adopted for floodway areas; and (5) ecological balance of riverbank areas should be considered. In the first action under the Program. Broome County designated an acquisiton zone along the Susquehanna River and began purchasing land. (Elfers-North Carolina) W73-14679

WATER SUPPLY PLAN (REVISED) FOR COLUMBUS-FRANKLIN COUNTY, Mid-Ohio Regional Planning Commission, Colum-For primary oibliographic entry see Field 06D. W73-14679

HOWARD COUNTY, INDIANA: COMPREHEN-SIVE WATER AND SEWER PLAN. Hamilton (Ernest R.) Associates, Inc., Indianapolis, Ind.

Prepared for Howard County Plan Commission, Kokomo, Indiana, April, 1970. 71 p, 13 fig, 30 tab.

Descriptors: \*Planning, \*Water supply, \*Sewerage, Soil types, Septic tanks, Urbaniza-tion, Regulation, \*Indiana. Identifiers: \*Howard County (Ind.), Data inventories, Comprehensive development plan, Subdivi-sion regulations.

This study was sponsored by the Farmers Home Administration and covers all of Howard County Administration and covers all of Howard County except the city of Kokomo. The report is divided into two parts: the first is a presentation of data and maps on the natural resources of the county, its population, economy, land use, community facilities, and utilities; the second part outlines a general planning strategy for providing water and sewer facilities to the county. The two key factors on which the study was based are the significant urbanization taking place in the county and the ability of various soils to support private septic tanks and wells. It is recommended that the county adopt subdivision regulations dealing with septic tanks and surface drainage, that the areas of Russiaville, West Middleton, and Greentown begin to develop public water and sewer systems, and that a comprehensive development plan be formulated a comprehensive development plan be formulated to help guide urbanization in the rest of the county away from poor soils. (Elfers-North Carolina) W73-14680

WATER AND WASTEWATER PLAN FOR AN-DERSON, BLOUNT, AND KNOX COUNTIES, TENNESSEE - VOLUME I, WATER SUPPLY AND DISTRIBUTION. Allen and Hoshall, Memphis, Tenn. For primary bibliographic entry see Field 05G. W73-14682

WATER AND WASTEWATER PLAN FOR AN-WAIEW AND WASTEW ALER FLAN FUR ANDERSON, BLOUNT, AND KNOX COUNTIES, TENNESSEE - VOLUME II, WASTEWATER COLLECTION AND TREATMENT. Allen and Hoshall, Memphis, Tenn. For primary bibliographic entry see Field 05G. W73-14683

HYDROLOGIC SIMULATION. Lake County Regional Planning Commission, Waukegan, Ill. For primary bibliographic entry see Field 04A. W73-14685

THE URBAN RIVER: A STAFF PROPOSAL FOR WATERFRONT DEVELOPMENT IN THE DISTRICT OF COLUMBIA. National Capital Planning Commission, Washington, D.C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 - Price \$2,50. December 1972. 49 p, 29 fig, photos, 2 append.

Descriptors: \*Land use, \*Aesthetics, \*Recreation, City planning, Planning, Scenery, Parks, Land-scaping, Rivers, Potomac River, Anacostia River, \*District of Columbia. Identifiers: \*Waterfront planning.

Although there has been a growing concern for problems of water quality, sedimentation, and flooding of our rivers there has been much less inreceived the state of the state front areas and suggests numerous general policies and specific objectives for the development and redevelopment of these areas. Some of the policies include the preservation of the historical character of much of the waterfront, the encouragement of a variety of land uses, the increasing use of open areas outside the District of Columbia for recreation, and an effort to make the rivers and rivermore accessible to city residents and visitors. Detailed studies of specific waterfront areas id it is recommended that the Georare proposed ar are proposed and its recommended that the Georgetown and Anacostia waterfronts be acted on first. The impact of the improvement policies on specific features of the waterfront such as Buzzard Point, National Airport, George Washington

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

Memorial Parkway, Rock Creek, and Key Bridge is discussed. (Elfers-North Carolina) W73-14686

BETTER WATER FOR PEOPLE IN LAS VEGAS, Las Vegas Valley Water District, Nev. For primary bibliographic entry see Field 05G. W73-14688

#### 3E. Conservation in Industry

FUTURE MUNICIPAL AND INDUSTRIAL WATER REQUIREMENTS IN THE QU'APPELLE RIVER BASIN.
Saskatchewan Water Resources Commission, Regina. Investigation and Planning Branch.
For primary bibliographic entry see Field 06D.
W73-14231

#### 3F. Conservation in Agriculture

EFFICIENCY OF WATER USE AS IN-FLUENCED BY MICROMETEOROLOGICAL AND PHYSIOLOGICAL PROCESSES, Kanasa Water Resources Research Inst., Manhattan. For primary bibliographic entry see Field 02D. W73-14206

DENTRIFICATION BY ANAEROBIC FILTERS AND PONDS - PHASE II. Environmental Protection Agency, San Francisco, Calif. Water Quality Office. For primary bibliographic entry see Field 05D.

W73-14219

PROCEEDINGS - SIXTEENTH ANNUAL WATER CONFERENCE.
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 04A. W73-14224

RENOVATING SEWAGE EFFLUENT BY GROUNDWATER RECHARGE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 05D. W73-14225

PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON REMOTE SENSING IN ARID LANDS.
Arizona Univ., Tucson. Office of Arid Lands Studies.

For primary bibliographic entry see Field 07B.
W73-14326

APPLICATION OF A DIRECTIONAL REFLECTANCE MODEL TO WHEAT CANOPIES UNDER STRESS, Michigan State Univ., East Lansing. Dept. of Botany. For primary bibliographic entry see Field 07B.

THE KIN BINEOLA IRRIGATION STUDY: AN EXPERIMENT IN THE USE OF AERIAL REMOTE SENSING TECHNIQUES IN ARCHAEOLOGY.

New Mexico Archeological Center.
For primary bibliographic entry see Field 07B.

REMOTE SENSING OF IRRIGATION TECHNIQUES AND CROP PATTERNS IN THE DOUGLAS BASIN, ARIZONA, For primary bibliographic entry see Field 07B. W73-14350

-WATER FLOW IN SOIL IN PRESENCE OF SOYBEAN ROOT SINKS, Minnesota Univ., Minneapolis. Dept. of Soil Science. For primary bibliographic entry see Field 02G. W73-14367

A MATHEMATICAL MODEL OF WATER AD-VANCE AND FLOW IN SMALL EARTH CHAN-NELS, Washington State Univ., Pullman. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 04A. W73-14369

RUNOFF, EROSION, AND TILLAGE EFFI-CIENCY ON GRADED-FURROW AND TER-RACED WATERSHEDS, Agricultural Research Service, Temple, Tex. Blackland Conservation Research Center. For primary bibliographic entry see Field 04D. W73-14410

A MATHEMATICAL INVESTIGATION OF STEADY INFILTRATION FROM LINE SOURCES, Colorado State Univ., Fort Collins. Dept. of Mathematics.
For primary bibliographic entry see Field 02G. W73-14425

CHARACTERISTICS OF THE SOIL MATRIX THAT AFFECT WATER STORAGE AND MOVEMENT, Minnesota Univ., Minneapolis. Dept. of Soil Science. For primary bibliographic entry see Field 02G.

W73-14467

STRESS METABOLISM. II: CHANGES IN PROLINE CONCENTRATION IN EXCISED PLANT TISSUES, Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Plant Physiology. T. N. Singh, D. Aspinall, L. G. Paleg, and S. F.

Australian Journal of Biological Sciences, Vol 26, No 1, p 57-63, Feb 1973. 4 fig, 12 ref.

Descriptors: \*Amino acids, \*Metabolism, \*Moisture stress, \*Barley, \*Plant tissues, Plant growth regulators, Stress analysis, Water supply, Biochemistry, Plant physiology, Plant growth, Planting management, Hydrolosis.

This paper, second in a series on stress metabolism, explores the capacity of the various barley plant organs to accumulate free proline when isolated from the rest of the plant and subjected to a water stress under aerobic conditions. Shoot apices and excised root systems, and sections of the lamina and leaf sheath of the first leaf of 10-day barley plants were incubated on aerated polyethylene glycol solution or distilled water. The imino acid proline accumulated rapidly in the leaf lamina sections subjected to osmotic stress and less rapidly, after a delay of 16 hours, in those floated on water. Leaf sheath sections apices showed on increase in free proline content on either medium. Albino leaf sections accumulated no proline when floated on water or in the solution unless supplied with precursors for proline biosnythesis. Green tissue, however, accumulated a high concentration of proline on the solution alone. Neither chlorophyll nor functional

chloroplasts are essential, therefore, for proline accumulation during water stress. (See W73-14004, W73-14504 and W73-14505) (Bahre-Arizona) W73-14503

STRESS METABOLISM. IV: THE INFLUENCE OF (2-CHLOROETHYL) TRIMETHYLAM-MONIUM CHLORIDE AND GIBBERELIC ACID ON THE GROWTH AND PROLINE ACCUMULATION OF WHEAT PLANTS DURING WATER STRESS,

WATER STRESS,
Waite Agricultural Research Inst., Glen Osmond
(Australia). Dept. of Plant Physiology.
T. N. Singh, D. Aspinall, and L. G. Paleg.
Australian Journal of Biological Sciences, Vol 26,
No 1, p 77–86, Feb 1973. 4 fig, 2 tab, 22 ref.

Descriptors: "Amino acids, "Metabolism, "Moisture stress, "Wheat, "Plant growth substances, Osmotic pressure, Varieties, Hydrolysis, Proteins, Agricultural chemicals, Growth rates.

Rate and extent of proline accumulation under comparable water stress conditions varies, the potential appearing to vary directly with the ability of the genotype to yield under drought conditions in the field, and to recover after severe osmotically-induced stress. Wheat plants (cv. Gabo) were grown in nutrient solution, with results indicating that neither CCC nor GA3 influenced leaf water potential, which fell rapidly following exposure to elevated osmotic pressure in the rooting medium. CCC reduced plant dry weight, apex elongation, and shoot elongation, but had no effect on primorium formation on the apex. Water stress inhibited growth at the apex and shoot elongation; but these effects were undiminished by previous growth-retardant treatment. GA3, however, promoted both growth attributes even where growth had been completely inhibited previously by water stress and leaf water potential was falling rapidly. Free proline accumulation was promoted by previous CCC application in all plant organs, when subjected to water stress, but a reduction relieved accumulated proline as did application of GA3. Neither CCC nor GA3 varied the concentration of free proline in leaves of plants not subjected to water stress. (See also W73-14503) (Bahre-Arizona)

STRESS METABOLISM. III: VARIATIONS IN RESPONSE TO WATER DEFICIT IN THE BAR-LEY PLANT, Waite Agricultural Research Inst., Glen Osmond

Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Plant Physiology. T. N. Singh, L. G. Palag, and D. Aspinall. Australian Journal of Biological Sciences, Vol 26, No 1, p 65-76, Feb 1973. 5 fig. 5 tab, 29 ref.

Descriptors: \*Amino acids, \*Metabolism, \*Mositure stress, \*Barley, \*Chlorophyll, Leaves, Plant growth regulators, Soil-water-plant relationships, Hydrolysis, Growth rate, Environmental control.

Barley plants (ev. Prior) grown in a controlled environment were subjected to 1, 2, or 3 cycles of water stress interspersed with periods of adequate supply. Stress-induced fall in leaf water potential was unaffected by previous drought history. After each deficit period, leaf water potential recovered apidly to the level of plants not stressed. Chlorophyll content declined during stress, but recovered between stress periods. Previous exposure to stress lowered this decline. In contrast, free proline increased during stress and declined in the intervals. Here, previous exposure to stress increased the potential for proline accumulation it issue. Responses of 14 different barley varieties to water stress were assessed. There were substantial varietal differences in proline accumulation related to leaf survival during stress and plant growth rate following stress. Varieties accumulating larger concentrations tended to have leaves

#### Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3F-Conservation in Agriculture

that survived extreme water stress more readily and grew more rapidly following stress relief. (See also W73-14503) (Bahre-Arizona) W73-14506

ECONOMIC ASPECTS OF SLOPING LAND DRAINAGE, Agricultural Research Service, Burlington, Vt. Water Conservation Research Div. For primary bibliographic entry see Field 04A. W73-14528

EFFECT OF TEMPERATURE AND HUMIDITY STRESS DURING FLOWERING ON SAF-FLOWER (CARTHAMUS TINCTORIOUS L.), Agricultural Research Service, Tucson, Ariz. Plant Science Research Div.

Crop Sci. Vol 12, No 5, p 637-640. 1972. Identifiers: Carthamus-tinctorius, Flowering, Genotype, \*Humidity, \*Safflower, Stress, \*Temperature.

Sensitivity of safflower during flowering to temperature and humidity stress and genetic variation for such sensitivity has been in question. Cultivars were grown in the greenhouse under similar conditions except for a 24-hr period during anthesis when they were exposed to temperature and humidity differentials in controlled environment chambers. Plants were exposed to these differentials on the day the second sequentially developing head began blooming, thus enabling measurement of sensitivity to temperature and humidity stress during pre-, post-, and anthesis stages of head development. Heads in anthesis and pre-anthesis were the most sensitive to temperature and humidity stresses. Cultivars responded differently to the stresses for seed number, weight, and yield. Results of the experiment suggest that screening safflower genotypes for tolerance to temperature and humidity stress using controlled environment chambers is practical and 24-hr exposure during anthesis is sufficient to differentiate genotypes.—Copyright 1973, Biological Abstracts, Inc.

ANALYSIS OF MONTHLY RAINFALL PROBABILITIES BY WEIGHTED TRANSFORMATION.

Engineering Consultants, Inc., Denver, Colo. For primary bibliographic entry see Field 02A. W73-14565

EFFECTS OF TREES AND FORESTS IN NEUTRALIZING WASTE, Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 05D.

W73-14610

SPRAY IRRIGATION OF SEWAGE EFFLUENT AND SLUDGE, Pennsylvania State Univ., University Park. School of Forest Resources.

For primary bibliographic entry see Field 05D. W73-14612

WHAT INVESTIGATIONS ARE REQUIRED TO OBTAIN INTENSIVE AND HEAVY-YIELD VARIETIES OF WINTER WHEAT,

Polish Academy of Sciences, Warsaw. Inst. on Agricultural and Forestry Economics. T. Ruebenbauer.

Postepy Nauk Roln. Vol 18, No 4, p 5-14. 1971. Illus.

Identifiers: Breeding, \*Drought resistance, \*Wheat varieties, \*Crop yield, Winter-hardiness.

Short-strawed varieties of wheat are susceptible to drought and lack winterhardiness. They should be bred for a greater water potential. Attempts should be made to break the correlation between short-strawed varieties and nonresistance to drought. Winterhardiness of short-strawed varieties needs to be improved. With 5 genes conditioning this trait, it is possible to produce hybrids excelling the parts.—Copyright 1973, Biological Abstracts, Inc. W73-14616

MODELLING TECHNIQUES FOR A SYSTEM ENGINEERING APPROACH OF THE PROBLEMS OF WATER USES FOR AGRICULTURAL PURPOSES,

Padua Univ. (Italy). Instituto di Elettrotecnica e di Elettronica.

For primary bibliographic entry see Field 08B. W73-14673

FIBERGLASS PLASTIC CASING OVERCOMES CORROSION PROBLEM IN WATER WELLS IN WEST PAKISTAN, Tepton and Kalmbach, Inc., Denver, Colo.

Tepton and Kalmbach, Inc., Denver, Colo. For primary bibliographic entry see Field 04B. W73-14722

EFFECTS OF WATER STRESS, GIBBERELLIC ACID AND 2-CHLOROETHYLTRIMETHYLA-MMONIUMCHLORIDE (CCC) ON FLOWER DIFFERENTIATION IN 'EUREKA' LEMON TREES, Hebrew Univ., Rehovoth (Israel). Dept. of

Hebrew Univ., Rehovoth (Israel). Dept. Agricultural Botany. For primary bibliographic entry see Field 021. W73-14737

EFFECTS OF BLACK POLYETHYLENE MULCH ON SOIL TEMPERATURE, SOIL MOISTURE, WEED DENSITY AND YIELD OF MULBERRY LEAF UNDER DRY FARMING CONDITIONS IN MYSORE STATE, Central Sericulture Research Training Inst.,

Mysore (India). K. Kasiviswanathan, M. N. Sitarama Iyengar, and S. Krishnaswami.

Indian J Seric, Vol 10, No 1, p 90-95, 1971. Identifiers: Density. Dry farming, \*India, Moisture, \*Mulberry leaf, \*Mulch, Mysore, \*Soil temperature, Weed, Yield.

In Mysore, India, where more than 4/5 of the mulberry area is grown under scanty rainfall conditions as a dry crop, leaf production is meager in Dec.-April due to inadequate soil moisture. The plastic cover was efficient in retaining moisture. Mulberry production increased by as much as 43% and leaf quality improved.--Copyright 1973, Biological Abstracts, Inc. W73-14748

# 04. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control of Water on the Surface

PROCEEDINGS - SIXTEENTH ANNUAL WATER CONFERENCE.
New Mexico State Univ., University Park. Water Resources Research Inst.

Available from the National Technical Information Service as PB-223 379, \$5.25 in paper copy, \$1.45 in microfiche. Proceedings held at Las Cruces, New Mexico, March 25-26, 1971, 197 p. OWRR A-999-NMEX (6). Descriptors: \*Water resource development, Engineering, \*Planning, \*Management, \*Water law, Sewage disposal, \*Irrigation, Systems analysis, Sediment, Herbicides, Corn, New Mexico, Texas, Arizona, Antitranspirants, Tamarisk. Identifiers: Cochiti Dam, Navajos, Rio Grande.

Water is the most limiting resource in New Mexico and the water that we have is the State's greatest asset. Surface and subsurface water is used to supply growing municipal and industrial demands and to irrigate the land. According to the Senate Select Committee Report of 1961 and the Water Resources Council Report of 1968, a major part of the State is facing the most critical shortage of water in relation to projected demands of any other area of the Nation. In addition to papers discussing New Mexico's specific water problems, other papers dealt with renovating sewage effuent, systems analysis in water resource management, irrigation of corn, Arizona's water problems, antitranspirants, sediment, herbicides, irrigation, consumptive requirements, water and the Navajos, and water law.

ANTITRANSPIRANTS: A POSSIBLE ALTERNA-TIVE TO THE ERADICATION OF SALTCEDAR THICKETS.

Arizona Univ., Tucson. Dept. of Watershed Management. For primary bibliographic entry see Field 03B. W73-14226

GULL LAKE-WATER LEVEL STABILIZATION. Red Deer Regional Planning Commission (Alberta). For primary bibliographic entry see Field 06E. W73-14232

FLOOD PLAIN INFORMATION, CLARK-SVILLE, TENNESSEE. Army Engineer District, Nashville, Tenn.

Prepared for the City of Clarksville, Tenn. 1964. 26

p, 12 plates, 4 tab, 11 ref, glossary.

Descriptors: \*Flood control, \*Flood data, Flood

plains, Flood damage, Flood protection, Urbanization, "Tennessee. Identifiers: "Flood plain management, Cumberland River, Clarksville (Tenn), Army Corps of Engineers, Red River (Tenn).

Flood losses in Clarksville from the Cumberland River and the Red River have been relatively small in the past. This is largely due to the existence of three Corps of Engineers reservoirs in the headwaters of the Rivers and the few number of re-sidences located in the flood plain areas of the City. As urban growth and renewal continues, strong pressures are emerging to build on the flood plain. Past floods in the area and areas of potential flood hazard are described. There are numerous maps, cross section diagrams, and charts illustrat-ing past flooding problems and photographs in-dicating levels of potential floods in relation to existing development. Non-structural flood control measures such as existing flood protection measures including flood warning and emergency evacuation plans and guidelines for reducing fu-ture flood damages with emphasis on flood plain management are briefly discussed. Recommendation is made for careful study to determine the relative economy of restricting and, in some cases prohibiting, construction which would be subject to flooding. Other considerations must also be studied before objective flood plain management can be initiated to balance the economic and aesthetic needs of a community with the natural demands of two active rivers. (Elfers-North Carolina)

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface-Group 4A

AMARILLO, TEXAS: REPORT ON WATER DISTRIBUTION SYSTEM, 1967. Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 06D.

A GENERAL SPATIAL MODEL: I. APPLICA-TION OF EFFICIENT LAND USE, Ministry of Works, Wellington (New Zealand). Water and Soil Div.

water and soil DIV.

B. St Clair-Corcoran.

J Hydrol (Dunedin), Vol 10, No 2, p 127-132, 1971.

Identifiers: "Land use, Model studies, "Spatial models, "Negentropy.

A new energy form is postulated from which a general model is synthesized. This general model uses the idea of hydrological efficiency constants to consider the question of efficient land use practice. The negentropy of water (the empirical measure of the efficiency of distribution of the usable energy of water) is referred to as a hydrological efficiency constant, and it is noted that the negentropy of water is a sensitive indicator of the stability of a given society in real terms.--Copyright 1973, Biological Abstracts, Inc. W73-14257

PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON REMOTE SENSING IN ARID LANDS. Arizona Univ., Tucson, Office of Arid Lands Stu-

For primary bibliographic entry see Field 07B.

W73-14326

BASIC CONSIDERATIONS OF HIGH RESOLU-TION SIDE-LOOKING RADAR IMAGERY, Goodyear Aerospace Corp., Litchfield Park, Ariz. Sensor Applications Engineering. For primary bibliographic entry see Field 07B. W73-14332

THE APPLICATION OF RADAR AND IN-FRARED IMAGERY TO QUANTITATIVE GEOMORPHOLOGICAL PROBLEMS, Texas Univ., Austin. Bureau of Economic Geolo gy. For primary bibliographic entry see Field 07B. W73-14333

THE USE OF REMOTE SENSING TECHNIQUES IN THE ARID LANDS OF AUS-TRALIA,
California Univ., Santa Barbara. Geography
Remote Sensing Unit.
For primary bibliographic entry see Field 07B.
W73-14335

COMPARATIVE EVALUATION OF THERMAL PROFILE DATA OF HEALTHY AND INFESTED ENGLEMANN SPRUCE, Forest Service (USDA), Phoenix, Ariz. Bureau of Pest Control.
For primary bibliographic entry see Field 07B.
W73-14337

THE APPLICATION OF SPACE IMAGERY TO ANTHROPOLOGY,
New Mexico Archeological Center.
For primary bibliographic entry see Field 07B.
W73-14342

MONITORING THE EFFECTS OF A CHANG-ING RESOURCE BASE IN AN ARID LANDS AREA: THE WEST SIDE OF THE SAN JOAQUIN VALLEY, CALIFORNIA, California Univ., Santa Barbara. Geography Remote Sensing Unit. For primary bibliographic entry see Field 07B.

W73-14345

W73-14348

AUTOMATED PLOTTING AND UPDATE OF LAND USE MAPS AND RELATED INFORMA-TION IN SOUTH CENTRAL ARIZONA, Geological Survey, Washington, D.C. Geographic Applications Program. For primary bibliographic entry see Field 07C. W73-14347

**GEOLOGIC-TERRAIN** MAPPING FOR LAND-USE PLANNING IN THE Geological Survey, Denver, Colo. For primary bibliographic entry see Field 07C.

A MATHEMATICAL MODEL OF WATER AD-VANCE AND FLOW IN SMALL EARTH CHAN-

Washington State Univ., Pullman. Dept. of Agricultural Engineering.
D. L. Bassett, and D. K. McCool.

D.L. Bassett, and D. K. McCool. Available from the National Technical Informa-tion Service as PB-223 433, \$2.75 in paper copy, \$1.45 in microfiche. Project Completion Report, July 12, 1973, 22 p. 2 fig, 6 ref. OWRR A-053-WASH (1). 14-31-0001-3848.

Descriptors: \*Mathematical models, \*Furrow irrigation, \*Computer programs, \*Open channel flow, Flow, Equations, Boundaries (Surfaces).

The objective was the development of a mathematical model of unsteady, spatially varied open channel flow in small earth channels. Furrow irrigation, a notable example of such flow, was used to illustrate the development. During this first year the mathematical basis of the model was prepared. This involved the complete partial differential equations of continuity and momentum written for small earth channels where infiltration into the channel bed depletes the flowing stream. Since the equations cannot be solved in closed form a procedure was prepared for obtaining approximate solutions by numerical methods. This procedure uses the method of characteristics on a fixed uses the method of characteristics on a fixed rectangular grid. Description was prepared for the five sets of boundary conditions that can occur in furrow irrigation. A preliminary description of water movement into the channel bed and walls was developed. These and other provisions have been assembled into a model and associated digital computer program which describes the complete furrow irrigation process. Provision is included to describe the disposal of water within and from the channel that will result from given flow conditions. The model is operational and is now being tested and revised as needed.

W73-14369

THEORY OF A RECTANGULAR GRAVEL ENlowa State Univ., Ames. Dept. of Agronomy.

D. Kirkham, and M. S. Selim.

Soil Science Society of America Proceedings, Vol

37, No 4, p. 517-521, July-August 1973. 5 fig. 5 tab,

8 ref. NSF Grant GK-31137. VELOPE IN DRAINAGE DESIGN

Descriptors: \*Subsurface drains, \*Subsurface drainage, Soil water movement, Equations. Identifiers: Gravel-packed drain tubes.

A theory was developed to determine the radius of a circular drain which is equivalent to a square drain. A square drain is encountered in practice when a gravel envelope of square cross section is placed around a subsurface circular drain. The resistance of the gravel to flow was neglected. The square drain tube was analyzed for two cases: (1) square trant tube was analyzed for two Cases: (1) when an impermeable barrier was at great depth below the square drain tube center, and (2) when the bottom edge of the square drain tube lay on a plane impermeable barrier. In both cases it was assumed that the length of the edge of the square drain tube was small compared with the distance from the drain's center to a water table over the drain, and that the drain ran full. For case 1 an equivalent circular drain tube of radius 1.1772 times the half-width of the square drain tube be used to replace the square drain tubes. If the square drains lie on the impervious layer, as in case 2, the radius of the equivalent circular drain is 1.037. (K napp-USGS) W73-14420

PROBLEMS OF WATER RESOURCES USE AND CONSERVATION (PROBLEMY VOD-NYKH RESURSOV, IKH ISPOL'ZOVANIYA I NYRH RESURSOV, IRH ISPOL-ZOVANIYA I OKHRANY),
Institute of Geography of Siberia and the Far East, Irkutsk. (USSR).
For primary bibliographic entry see Field 06B.
W73-14427

HYDROLOGIC REGIME OF CONIFEROUS BROAD-LEAVED FOREST TREES IN THE SOUTHERN MARITIME TERRITORY (GIDROLOGICHESKIY REZHIM KHVOYNO-SHIROKOLISTVENNYKH LESOV YUZH-NOGO PRIMOR'YA), Akademiya Nauk SSSR, Vladivostok. Institut

Biologii. For primary bibliographic entry see Field 021.

W73-14432

FLOW REGULATION FOR WATER QUALITY MANAGEMENT, Cornell Univ., Ithaca, N.Y. Dept. of Environmen-For primary bibliographic entry see Field 05G.
W73-14466

SOME FACTORS INFLUENCING TOLERANCE TO MOISTURE STRESS OF THREE RANGE GRASSES, Idaho Univ., Moscow. Forest, Wildlife and Range

toano Univ., Moscow. Forest, whome and Range Experiment Station. E. F. Schlatterer, and M. Hironaka. Journal of Range Management, Vol 25, No 5, p 364-367, Sept. 1972. 3 tab, 5 ref.

Descriptors: "Moisture stress, "Range grasses, "Drought tolerance, "Soil-water-plant relationships, Seeds, Planting management, Nutrients, Plant growth, Temperature control, Growth rates,

Pre-conditioning of bluebunch wheatgrass, squir-reltail, and Thurber stipa plants by exposure to dif-ferent temperatures and watering schedules, as well as soil types, affected their tolerance to moisture stress. Vigor of seedlings in mound soil was greater than for intermound soil during the first 11 weeks as suggested by plant height and weight. This was attributed to higher nutrient availability, particularly nitrogen. Reversal in growth response occurred during the 5-week moisture stress period. Plants on less fertile intergrowth response occurred during the 3-week moisture stress period. Plants on less fertile intermound soil produced more regrowth than those on mound soil. Conditioning of plants to stress eas affected by soil. Within limits, growing conditions less than optimum tend to produce plants able to tolerate greater moisture stress. Pre-conditioning of plants to resist or withstand moisture stress should be considered where availability of moisture is a major concern. (Bahre-Arizona) W73-14475

FLOOD CONTROL REPORT, CASA GRANDE, ARIZONA, 1973. Henningson, De n, Durham and Richardson, Inc.,

June 25, 1973. 47 p, 5 tab, 10 plates. HUD-701. CPA-AZ-09-16-1008.

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control of Water on the Surface

Descriptors: "Flood control, "Drainage engineering, "Lateral conveyance structures, "Urban drainage, "Project planning, "Arizona, Arid climates, Design flood, Surface runoff, Flood routing, Cost analysis. Identifiers: \*Casa Grande (Ariz).

Situated in the south-central portion of Arizona in the Sonoran Desert, the city of Casa Grande lies at an elevation of 1500 feet with a slope down to approximately 1200, and is drained by many arroyos and washes, with alluvial fill characterizing the surrounding areas. The climate is typical of the arid desert region, with high summer temperatures, and both winter and summer precipitation. the latter tending to be of high intensity. In at-tempting a flood control plan, it was necessary to consider the surrounding terrain, and to try to predict the nature of planned community develop-ment. Since much of the growth of the City is expected to take place in exactly those areas subject to serious flooding without proper planning, drainage design criteria were paramount in the recommendations. A 50-year storm frequency was selected as a base for the master plan consisting primarily of a combination of roadways, roadways with center channels, open channels, and retention lakes. Because of excessive costs involved, only limited use of underground drainage was pro-jected. A grade ordinance plat was developed for the entire study areas to pemit housing construc-tion at elevations above flood levels. The entire plan is projected for implementation in 4 phases at a total cost of fifteen million dollars, and details of work to be undertaken in each are given in a series of plates. (Paylore-Arizona) W73-14476

WESTERN WHEATGRASS GERMINATION AS RELATED TO TEMPERATURE, LIGHT, AND MOISTURE STRESS,

Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment

Journal of Range Management, Vol 26, No 1, p 68-69, January 1973. 1 fig, 1 tab, 1 ref.

O. D. Knipe

Descriptors: \*Wheatgrasses, \*Light, \*Temperature, \*Germination, \*Moisture stress, Soil stabilization, Rhizomes, Seeds, \*New Mexico, Plant growth, Semiarid climates, Alkaline soils. Identifiers: \*Rio Puerco watershed (N Mex).

Western wheatgrass (Agropyron smithii Rydb.) was chosen for study to determine whether it could aid in soil stabilization in the badly depleted Rio Puerco watershed of west central New Mexico. Its qualities that make it suitable are that it is a rizomatous long-lived perennial with high soil-stabilizing potential, it is adapted to alkaline soils, and its seedlings are vigorous and develop rapidly. Germination of western wheatgrass was best when seeds were held for 16 hr at temperatures between 55 and 75 degrees Fahrenheit, and 8 hr at temperatures between 75 and 90 degrees F daily. Germination was independent of light, but was severely reduced by moisture stresses above 1.0 atm. The detrimental effect of moisture stress was increasingly severe with increasing temperature above num. (Bahre-Arizona)

CHEMICAL COMPOSITION OF SOUTHERN GREAT PLAINS GRASSES AS RE-LATED TO SEASON AND PRECIPITATION,
Texas Tech Univ., Lubbock. Dept. of Range and
Wildlife Management. E. E. Willard, and J. L. Schuster.

Journal of Range Management, Vol 26, No 1, p 37-38, Jan. 1973. 1 fig, 5 ref.

Descriptors: \*Range grasses, \*Chemical proper-ties, \*Seasonal, \*Great Plains, \*Precipitation (At-mospheric), Proteins, Ethers, Evaporation, En-vironmental effects, Plant growth substances,

Moisture availability, Semial Southwest U.S., \*Texas. Identifiers: \*Llano Estacado (Tex). Semiarid climates,

Grass samples collected from the Llano Estacado orass samples collected from the Liano Estacado
of Texas were analyzed to ascertain whether erratic rainfall affects the percentage of chemical
fractions. The climate is typified by dry winters
and by spring and late summer rainfall. High winds
and high temperatures during the growing season
result in high evaporation rates which reduce
moisture available to plants. Seasonal influences moisture available to plants. Seasonal influences caused variations in crude protein, ether extract, ash, crude fiber, and water. Nitrogen-free extract did not show a seasonal trend. Crude protein, crude fiber, and water content were directly influenced by the rainfall pattern during the growing season, but rainfall did not appear to significantly affect the other chemical components. (Bahre Arizona) W73-14482

OBION AND FORKED DEER RIVERS AND TRIBUTARIES, TENNESSEE AND KENTUCKY, INTERIM REPORT: HARRIS FORK CREEK. Army Engineer District, Memphis, Tenn.

June, 1971, 38 p. 4 plates, 7 tab, photos, 6 append.

Descriptors: \*Flood control, \*Cost-benefit analysis, \*Channel improvement, Flood protection, \*Tennessee, \*Kentucky, Flood plains, Flood damage, Cost-benefit ratio.

ers: \*Flood plain management, Harris Fork Creek (Tenn.), South Fulton Branch (Tenn.), Fulton (Tenn.), South Fulton (Tenn.), Obion River (Tenn.), Forked Deer River (Tenn.)

The District Engineer recommends that the West Tennessee Tributaries Project adopted by the Flood Control Act of 30 June 1948 be modified to include a project for flood control along Harris Fork Creek and its tributary, South Fulton Branch, at an estimated Federal cost of \$2,813,000, to consist of channel pavement and enlargement. The study describes the authority under which investigations were made, prior re ports completed, the natural characteristics of the ports completed, the natural characteristics of the study area, the area's flooding characteristics and problems, and existing flood control improve-ments of the Corps and other federal and non-federal agencies. Based on this, alternative im-provement plans are formulated with cost estiates and an economic analysis of each, noting benefits from flood damages prevented, increased utilization of lands, advanced bridge replacement, use of local unemployed labor, and others, to provide an estimate of average annual benefits. The selected plan is analyzed in greater depth in costbenefit terms. Extensive appendices give technical data. (Edwards-North Carolina) W73-14502

FUTURE ALLOCATIONS OF LAND AND WATER: IMPLICATIONS FOR AGRICULTURAL AND WATER POLICIES, Iowa State Univ., Ames. Center for Agricultural and Rural Development.
For primary bibliographic entry see Field 06D.
W73-14521

ECONOMIC ASPECTS OF SLOPING LAND Agricultural Research Service, Burlington, Vt. Water Conservation Research Div. J. Bornstein, and C. L. Fife. Journal of Soil and Water Conservation, Vol 18, No 2, p 76-79, 1973. 2 fig, 5 tab, 4 ref.

Descriptors: \*Drainage practices, \*Investment, \*Return (Monetary), \*Alfalfa, Diversion, Subsurface drainage, Vermont, Crop production, Forages, Installation costs, United States, Identifiers: Cabot silt loam.

Effective drainage is an essential factor in the profitability of farming in the northeastern United States and eastern Canada. Alfalfa survival, hay States and eastern Canada. Attatta survival, hay yield, and composition data for seven years of record were employed to indicate response to three surface-subsurface drain treatments of four plots each. The plots were on Cabot silt loam which is a poorly drained, sloping fragipan soil. Although hay yields were not dramatically affected by drainage differences, alfalfa yields increased significantly as drainage intensity in-creased. Most dramatic was the effect of improved drainage on winterkill. Alfalfa survived severe winterkill conditions at rates of 31, 15, and 3% on subsurface drain spacings of 100- and 200-feet and no subdrains, respectively. Considering only yields and alfalfa quality the 200-foot subsurface system was more profitable. However, the 100foot subdrain resulted in a much higher alfalfa survival during the 1966 winterkill. Thus, cost savings associated with reseeding should be compared with higher installation cost of the 100-foot subdrain and future prices predicted in order to deter-mine the optimal long-term investment. (Weaver-W73-14523

U.S. DEEPWATER PORT STUDY. VOL. 1. SUM-MARY AND CONCLUSIONS, Nathan (Robert R.) Associates, Inc., Washington,

For primary bibliographic entry see Field 06B.

ORIGINS AND ECOLOGY OF THE SIERRAN ALPINE FLORA AND VEGETATION, New Hampshire Univ., Durham. Dept. of Botany. Brian F. Chabot, and W. D. Billings. Ecol. Monogr. 42 (2): 163-199. Illus. 1972. Identifiers:

Identifiers: \*Alpine flora, Artemisia-Tridentata,
\*California, Chloroplasts, Ecology, Ephedra-Nevadensis, Light, Moisture, Pinus-spp., Nevadensis, Reproduction, Respiration, Seasons, Sierran, Soils, Starch, Temperature, Tetradymia-Spinosa, Translocation, \*Vegetation.

The primary study area was a transect from the desert near Bishop, California, (1400 m), to Piute Pass in the Sierra Nevada (3540 m). Upward along the transect the vegetational gradient is Ephedra nevadensis-Tetradymia spinosa desert shrub, Pinus monophylla-Artemisiatridentata open woodland, Pinus jeffreyi open forest, Pinus mur-rayana forest, Pinus albicaulis-sub-alpine herbaceous vegetation, and scattered alpine commu-nities. Only 19% of the alpine species at Piute Pass occur in the Arctic, whereas 38% are held in common with the Rocky Mountains. Species endemic to the Sierra (17%) are in general predominantly from the Californian or Great Basin floras of lower elevations. A number of species have populations in the desert and also at high elevations near the alpine zone. Most of the alpine flora consists of perennials, but several annual species are also perennials, out several annual species are also present. Annuals are rare in other arctic and alpine floras. Strong vegetation patterning occurs along drainageways from snowbanks or perrenial streams. Solar, sky, and net radiation at 1 m above the soil are greater for alpine than for desert areas. Air and plant-tissue temperatures near the surface of the alpine soil are higher than those in most other alpine areas. Germination of seeds from alpine plants occurred maximally between 20 and 30C. The low winter temperatures of the alpine zone appear to operate as an exogenous dormancy control. Temperatures of the upper photosynthetic compensation point and maximum net photosynthesis are lower in plants of alpine spe-cies. Acclimation of dark respiration appear re-lated to changes in the rate of mitochondrial oxidation. Translocation of starch from chloroplasts at low temperatures was impaired in a desert species, but was maintained in a alpine species. There is no indication that any single process, or adaptation to temperature alone, is responsible for the evolution and success of an alpine species. Efficient utiliza-

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface-Group 4A

tion of a short, cold growing season may be the most important selective characteristic in the origin of an alpine flora.—Copyright 1973, Biological Abstracts, Inc. W73-14545

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1971-NOVEMBER 30, 1972, Geological Survey, Washington, D.C. J. V. B. Wells, and R. E. Fish. June 1973. 82 p, 3 fig. 1 plate, 19 tab.

Descriptors: \*Delaware River, \*Hydrologic data, \*Hydrologic budget, \*Streamflow, \*Water quality, Precipitation (Atmospheric), Runoff, Water yield, Floods, Reservoirs, Estuaries, Chemical analysis, Basic data collections, Hydrology, Water supply, Flow rates, Water temperature, Water utilization, Watershed management, Reservoir operation.

The River Master daily operation records were prepared by the Milford office of the Delaware River Master from basic data collected principally on a day-to-day basis by several agencies. The 1972 report year, December 1, 1971 to November 30, 1972, was a year of excessive precipitation and much above average runoff in the Delaware River basin. Severe floods associated with Tropical Storm Agnes occurred in the lower portion of the basin during June. The annual flow of Delaware River at Montague adjusted for change in reservoir storage and diversions was about 60% above median and the highest for the period of record beginning 1940. Pepacton, Cannonsville, and Neversink Reservoirs of the city of New York spilled during the spring and early summer. Diversions and releases from the reservoirs of the city of New York were made within the terms of the Amended Decree. Diversions by New Jersey through the Delaware and Raritan Canal were within prescribed limits of the Amended Decree. Precipitation on the basin above Montague for the 1972 report year was excessive, totaling \$2.06 inches, which was the second highest for a report year in the period of record beginning December, 1940. (Woodard-USGS)

DECISIONS WITH INADEQUATE HYDROLOG-IC DATA. For primary bibliographic entry see Field 02A. W73-14550

COMPUTATIONS OF PEAK FLOODS WITH IN-ADEQUATE HYDROLOGIC DATA, Columbia Univ., New York. For primary bibliographic entry see Field 02A. W73-14556

CONCEPT OF A TECHNIQUE FOR AN ANALY-SIS OF WATERSHED RUNOFF EVENTS, Agricultural Research Service, Riesel, Tex. Soil and Water Research Div. For primary bibliographic entry see Field 02A. W73-14559

ON THE USE OF SHORT-TERM DATA FOR STREAMFLOW SYNTHESIS, Pittsburgh Univ., Pa. Dept. of Civil Engineering. For primary bibliographic entry see Field 02A.

A SIMILAR STORM METHOD ON FILLING DATA VOIDS, Tokushima Univ., (Japan). Dept. of Engineering. For primary bibliographic entry see Field 02A. W73-14564 INADEQUATE HYDROLOGIC DATA AND RESERVOIR CAPACITY, Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A. W73-14567

EFFECTS OF INADEQUACE OF HYDROLOGIC DATA ON RELIABILITY OF WATER RESOURCES DESIGN, Osaka Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14568

EVALUATION OF DROUGHT EFFECTS AT LAKE ATITLAN, Hydrologic Engineering Center, Davis, Calif. For primary bibliographic entry see Field 02A. W73-14569

THEORETICAL ANALYSIS OF THE ROLE OF SUBSURFACE FLOW IN THE GENERATION OF SURFACE RUNOFF: 2. UPSTREAM SOURCE AREAS, IBM Watson Research Center, Yorktown Heights,

For primary bibliographic entry see Field 02A. W73-14608

BASED ON THE EXAMPLE OF THE ZHDANOV PORT AREA (OPYT SPETSIALIZIROVANNOY KHARAKTERISTIKI GIDROLOGICHESKOGO REZHIMA NA PRIMERE RAYONA PORTA ZH-DANOV).

State Oceanographic Inst., Moscow (USSR). E. S. Karakash.

E. S. Karakash.

Available from the National Technical Information Service as AD-718 172, \$3.00 in paper copy,
\$1.45 in microfiche. Naval Oceanographic Office,
Washington, DC Report No. Trans-185, 1964.

Trans. from Trudy Gosudarstvennogo Okeanograficheskogo Instituta, Vol 34, p 5-72, 1957.

95 p, 21 fig, 49 tab, 26 ref, append.

Descriptors: Hydrologic aspects, \*Ice cover, \*Sea ice, \*Harbors, Navigation, Coasts, Freezing, Hydrology, Seacoast, \*Weather forecasting, Rivers, Winds, Sea level. Identifiers: Ice breakup, \*Zhdanov Port (USSR), \*Ice forecasting, Ice thickness.

The hydrological regime in the northwestern part of Tanganrogskiy zaliv, where the Zhdanov Port with its channel system is located, is discussed from the point of view of navigation. Therefore the wind, waves, and ice phenomena in the area are analyzed, taking into consideration systematic observations carried out by hydrological and hydrometeorological stations in the area from 1945 to 1954, as well as by special expeditions organized in the area during the mentioned decade. On the basis of observation data special equations are composed, with the aid of which it is possible to calculate and forecast the average length of the navigational period, and the dates of various ice phases such as the first appearance of ice, freezeup, breakup, and disappearance of ice, including variations in ice thickness, by months and by years. Also the occurrence of severe and mild winters and the effects of weather conditions in the region, as well as the peculiar constal contours in the Zhdanov Port area and the influence of river discharges are analyzed in detail. (Sinha-OEIS) W73-14632

OPTIMAL POLICY FOR RESERVOIR MANAGEMENT, McGill Univ., Montreal (Quebec). M. A. Muspratt. Nordic Hydrology, Vol 4, No 2, p 57-76, 1973. 5 fig, 15 ref, 2 append.

Descriptors: "Reservoir operation, "Management, "Optimization, "Profit, Stochastic processes, Algorithms, Constraints, Economics, Water supply, Hydrologic cycle, Water users, Reservoir releases, Water loss, Seepage, Evaporation, Damsites, Mathematical models, Systems analysis, "Optimum development plans. Identifiers: "Nonlinear programming, "Stochastic optimization.

The development of a rational management philosophy for existing reservoirs is being stimulated by the rapid exploitation throughout the world of dam sites which are economically and ecologically viable. A nonlinear, stochastic mathematical programming algorithm is used to maximize profit from the operation of a hypothetical reservoir over a finite time period. The problem is to manage the water released from the reservoir for domestic, industrial, irrigation, and low-flow augmentation uses so as to maximize the profit over the given period of time. Water may also be used for power generation, and losses are experienced due to seepage and evaporation. A transient hydrologic cycle is considered for the reservoir and its initial stored-water volume. The approach used to solve the problem is the sequential, unconstrained minimization technique (S.U.M.T.). S.U.M.T. is a stable and rapidly convergent method for optimization of nonlinear systems in which both the objective and the constraints are continuously twice differentiable (analytically or numerically). Further extensions to the proposed stochastic optimization procedure are described in Appendix A. (Bell-Cornell)

THE NATURAL VEGETATION OF THE SOUTHEAST SPANISH DRY AREA, Goettingen Univ. (West Germany). Systematisch-Geobotanisches Institut. H. Freitag.

Bot Jahrb Syst Pfianzengesch Pflanzengeogr, Vol 91, No 2/3, p 147-308, 1971, Illus, Map. Identifiers: Climates, Cutting, Dry areas, Grazing, Mining, Succession, "Vegetation, "Spain.

A coastal belt about 300 km in length and 20-40 km in width, located in the provinces of Alicante, Murcia and Almeria was studied. Except in the mountain ranges the annual mean precipitation is less than 400 mm, in large tracts less than 300 mm, and drops down to 128 mm at Cabo de Gata. The vegetation has been heavily influenced by man. Mining (Ag) which resulted in a high demand for fuel for smelting processes; grazing; cutting of timber, fire- and brush-wood; and exploitation of fiber plants (Stipa tenacissima) led to extensive destruction of the natural vegetation and to the 'steppic' character of the area. Five plant communities with zonal distribution were recognized as the essential components of the natural vegetation: Quercetum rotundifoliae; Rhamno-Quercetum cocciferae; Querco-Lentiscetum; Gymnosporio-Periplocetum. Detailed descriptions of the structure and floristic composition of these plant communities are given.—Copyright 1972, Biological Abstracts, Inc.

HYDROLOGIC SIMULATION. Lake County Regional Planning Commission, Waukegan, Ill.

Prepared for Northeastern Illinois Planning Commission, Chicago. September 1971. 6 p, 2 fig. HUD 701 grant.

Descriptors: \*Flood forecasting, \*Land use, \*Hydrologic models, \*Simulation analysis, Statistical methods, Flood plains, Flood data, Flood recurrence interval, Flood stages, Computer models, \*Illinois, Urbanization.

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control of Water on the Surface

Identifiers: \*Flood plain management, Impervious land cover, Impervious surfaces, Chicago River, \*Lake County (III).

A synopsis of two reports on a hydrologic simula-tion model for the watershed of the North Branch of the Chicago River by Hydrocomp International is presented. The simulation model is used to help correct for urban development in a hydrologic data series to be used in statistical analyses. Various physical processes such as runoff, snow melting, and infiltration plus parameters including the amount of impervious land cover are incorporated into the model. The simulation model in conjunction with statistical analysis can then predict flood stages and be used in flood mapping programs under various given levels of urbanization. The basic conclusion is that urban development can continue upstream without significantly increasing downstream flood stages if flood plain storage is preserved upstream. If flood plain storage is reduced upstream, the hydrologic regime will be entirely altered and the peak discharge for a 100-year flood could double or triple. Thus, upstream land use planning and control of flood plain areas is the key to flood control. However, detention basins and levees are also useful, particularly to protect existing urban development in flood prone areas. (Elfers-North Carolina) W73-14685

PRESSURE TRANSIENT ANALYSIS OF NATU-RALLY FRACTURED RESERVOIRS UNIFORM FRACTURE DISTRIBUTION, Atlantic Richfield Co., Dallas, Tex. For primary bibliographic entry see Field 08B. W73-14708

WATER SUPPLY PROJECTS IN DEVELOPING COUNTRIES,

Parsons (Ralph M.) Co., Los Angeles, Calif.

G. E. Arnold.

Journal of the American Water Works Association, Vol 62, No 12, p. 750-753, December, 1970.

Descriptors: \*Water supply, Water treatment, Water users, Water rates, Economics, Labor supply, Income, Design, Equipment, Technology,

Identifiers: \*International development agencies, Population growth, Improved living conditions, \*Developing countries.

The best and most important way to improve living conditions in developing countries is to provide safe water supplies. Certain adjustments must be made by a western engineer when planning and building in a developing country. The stage of development, funds available, and local conditions must be considered. Two basic principles that must be followed are simplicity and economy. It is cheaper and more dependable in most cases, due to the unskilled manpower available, to employ more people rather than install automatic equipment. The engineering design work on these projects should be done in the project country, using cal personnel wherever possible. In most cases AWWA standards will be acceptable. In setting water rates it is imperative that treated water be water lates it imperative that treated water or made available at an affordable price or the use of untreated water will continue; therefore, in many cases a reverse payment scale, charging large users more per unit than small users is a common practive. The training of operators is one of the most important phases of development and is usually part of the consulting engineer's contract. Operating and maintenance personnel are trained on site starting during the construction phase. Supervisory and management personnel are schooled at various locations such as the Public Health College of the University of North Carolina. Case studies of several recent projects are presented. (Smith-NWWA) W73-14716

EFFELT OF CLEARCUTTING A BLACK SPRUCE BOG ON NET RADIATION, Forest Service (USDA), Grand Rapids, Minn. Northern Conifers Lab. For primary bibliographic entry see Field 02D. W73-14736 EFFECT OF CLEARCUTTING A BLACK

PREDICTION PREDICTION OF SITE INDEX OF LODGEPOLE PINE FROM SELECTED EN-VIRONMENTAL FACTORS, Colorado State Univ., Fort Collins. Dept. of For primary bibliographic entry see Field 021. W73-14740

#### 4B. Groundwater Management

RENOVATING SEWAGE EFFLUENT BY GROUNDWATER RECHARGE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 05D. W73-14225

REPORT ON MAKEUP WATER FOR THE UPPER CANYON LAKES, LUBBOCK, TEXAS. Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 05G.

MATHEMATICAL MANAGEMENT MODEL OF PARTS OF THE OGALLALA AOUIFER, TEX-

AS, High Plains Underground Water Conservation District No. 1, Lubbock, Tex.
F. A. Rayner, D. M. Wells, B. J. Claborn, D. D.
Smith, and A. J. Sechrist.

Smith, and A. J. Sechist.
Available from the National Technical Information Service as PB-223 557, \$4.50 in paper copy, \$1.45 in microfiche. Final Report, July 1973. 111 p, 27 fig, 9 tab, 12 plates, 52 ref. OWRR C-2101 (H3363) (2).

Descriptors: \*Aquifer characteristics, Computers, \*Permeability, \*Storage coefficient, \*Optimiza-tion, \*Texas, Groundwater, Mathematical models. Identifiers: \*Ogallala Aquifer, Slaton channel (Tex), Parmer County (Tex), Steepest descent.

A digital computer procedure was developed for predicting to ultimate depletion a water table aquifer in which the configuration of the base of aquirer in which the configuration of the base of the aquifer becomes a controlling parameter. A portion of the 'Slaton Channel', a buried valley in the Ogallala Aquifer near Slaton, Texas, was selected for modeling. A rectangular system of nodes, with a small node spacing, was found to be most advantageous from the standpoints of ease of programming, use of CPU time, and computer core, storage requirement. The large numbers programming, use of CPU time, and computer core storage requirements. The large number of nodes resulting from the small node spacing made the Gauss-Seidel iteration method of solving systems of quadratic equations impractical. A parameter adjustment procedure was developed using the steepest descent optimization procedure for minimizing errors in simulated water levels. This procedure treated permeability and storage coefficients, as well as net withdrawals, as variacoefficients, as well as net withdrawals, as varia-bles for purposes of determining simulated water levels. The model developed in Phase I of the pro-ject was applied to Parmer County, Texas, after the completion of a very comprehensive investiga-tion and report on groundwater conditions in Au-gust, 1971. The results of this application indicate that the model is applicable to any area for which accurate net withdrawal rates in the future can be established (Wells-Texa) established. (Wells-Texas) W73-14359

OPTIMAL IDENTIFICATION OF AQUIFER PARAMETERS IN A DISTRIBUTE SYSTEM, California Univ., Los Angeles. Dept. of Engineer-

For primary bibliographic entry see Field 02F. W73-14375

IDENTIFICATION OF PARAMETERS IN FINITE LEAKY AQUIFER SYSTEM, California Univ., Los Angeles. Dept. of Engineering Systems. rimary bibliographic entry see Field 02F. W73-14376

SIMPLEST ORGANIC ACIDS IN GROUND-SIMPLEST ORGANIC ACIDS IN GROUND-WATER OF THE LOWER VOLGA REGION (GENESIS AND POSSIBLE USE IN PROSPECT-ING FOR OIL) (NIZSHIYE ORGANICHESKIYE KISLOTY V PODZEMNYKH VODAKH NIZH-NEGO POVOLZH'YA (GENESIS I VOZMOZH-NOST' ISPOL'ZOVANIYA V NEFTEPOIS-KOVYKH TSELYAKH), Nizhne-Volzhskii Nauchno-Issledovatelskii In-stitut Geologii i Geofiziki, Saratov (USSR). For primary W73-14434 bibliographic entry see Field 02K.

RIVERSIDE'S GROUND WATER PUMPING SYSTEM FMC Corp., Los Angeles, Calif. Peerless Pump

Water and Sewage Works, Vol 120, No 4, p 100-101, May 1973.

Descriptors: \*Pumped storage, \*Groundwater availability, \*Water wells, \*Pumping, Water supply development, Water table, \*California, Reservoir storage, Colorado River Compact, Metropolitan Water Dist. of So. Cal., municipal water, Subsurface waters, Water conveyance, Water distribution (Applied), River basins. Identifiers: Santa Ana River basin (Calif), \*River-

Riverside, California, located in the Santa Ana River basin, obtains practically its entire water supply from local wells. This underground river carries a steady flow of water from the San Bernardino Mountains to the Pacific Ocean. The Bernatuno mountains to the Facility of water table varies from year to year, depending on an average rainfall range of 5-15 inches, with an actual rise in the water table caused by heavy floods that inundated the area 2 years ago. Water is pumped from an average depth of 100 feet, aided enroute by booster pumps, to the City's 32-million gallon storage reservoir. These booster pump stations, located around the City, maintain adequate pressure to provide a steady flow of water at all times of the year, especially at higher elevations. Two percent of the water in the City's system comes from a connection with the Colorado River water distribution system and the Metropolitan Water District. Planning projections for the future indicate that Riverside's underground water resources will provide at least two-thirds of its needs. (Bahre-Arizona)

DETERMINATION OF SOME HYDROLOGI-CAL FACTORS WITH A WELL RECORDER, Ain Shams Univ., Cairo (Egypt). For primary bibliographic entry see Field 02A.

PROBLEMS OF GROUNDWATER USE AND CONSERVATION IN LITHUANIA (VOPROSY ISPOL'ZOVANIYA I OKHRANY PODZEMNYKH VOD YUZHNOY PRIBALTIKI).

Litovskiy Nauchno-Issledovatel'skiy Geologoraz-vedochnyy Institut Trudy, No 17, Vilnius, V. Juodkazis, editor, 1971. 156 p.

Descriptors: \*Groundwater, \*Water utilization, \*Water conservation, Groundwater movement, Groundwater recharge, Groundwater mining,

#### WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Watershed Protection—Group 4D

Hydrogeology, Aquifers, Water storage, Water ta-ble, Water levels, Water level fluctuations, Draw-down, Withdrawal, Safe yield, Water wells, Well filters, Water pollution, Water quality, Water chemistry, Glacial sediments. Identifiers: USSR, \*Lithuania SSR, Estonia SSR, Paleogeography, Mineralization.

Groundwater occurrence, movement, and conser-Groundwater occurrence, movement, and conservation in Lithuania were investigated in this collection of 13 papers published by the Lithuanian Scientific Research Institute of Geological Exploration. Problems relating to well hydraulics, artificial recharge, bacteriological contamination in aquifers, and chemical quality of groundwater are scussed, and estimates are given of maximum feasible withdrawal of groundwater for aquifers in a region of glacial sediments. (Josefson-USGS) W73-14606

BETTER WATER FOR PEOPLE IN LAS VEGAS, Las Vegas Valley Water District, Nev. For primary bibliographic entry see Field 05G. W73-14688

NEW APPROACHES TO WATER-RESOURCES INVESTIGATIONS IN UPSTATE NEW YORK, Geological Survey, Albany, N.Y. For primary bibliographic entry see Field 02F.

SELECTED BIBLIOGRAPHY ON LABORATO-RY AND FIELD METHODS IN GROUND WATER HYDROLOGY, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02F.

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS, Illinois State Geological Survey, Urbana.

K. Cartwright. Circular No. 433, 1968. 41 p, 27 fig, 4 tab, 42 ref.

Descriptors: \*Exploration, Prospecting, Geophysics, On-site investigations, Remote sensing, \*Subsurface investigations, Water sensing, "Subsurface investigations, Water sources, Equations, Electronic equipment, "Aquifer characteristics, Thermal properties, "Specific heat, "Illinois. Identifiers: Heat sink, Temperature anomaly, Electronic thermometer, Glacial Alluvial deposits, \*Groundwater exploration.

Most geophysical techniques used in the exploration for ground water measure some property of the rocks, rather than properties of water. How-ever, the presence of water in the rocks affects the results somewhat in electrical earth resistivity and seismic methods, the most commonly used exploration techniques. A property that may be ex-ploited in ground-water exploration is the high specific heat of water or its resistance to changes specific near of water of its resistance to changes in temperature. Theoretical considerations of glacial and alluvial deposits suggest that a saturated aquifer may disturb the geothermal gradient by acting as a heat sink (absorbing heat) (Lovering and Goode, 1963) or heat source. This disturbance may influence the surface soil temperature. If surface soil temperature variations resulting from disturbance of the geothermal gradient by a shallow aquifer can be measured, the presence of the aquifer might be detected. (Smith-NWWA) W73-14714

FIBERGLASS PLASTIC CASING OVERCOMES CORROSION PROBLEM IN WATER WELLS IN WEST PAKISTAN, Tepton and Kalmbach, Inc., Denver, Colo. D. K. Smith.

Society of Mining Engineers, AIME, Transactions, Vol 244, No 1, p 24-28, March, 1969.

Descriptors: \*Corrosion control, \*Bacteria, \*Water quality control, Water analysis, Materials, \*Water wells, Bactericides, \*Irrigation systems. Identifiers: \*Well rehabilitation, \*Sulfate-reducing bacteria, Chlorine shock treatment, Incrustation, \*Fiberglass plastic pipe, \*Pakistan.

The Reclamation Program for the Northern Zone of the Indus Plains in West Pakistan involves the construction of 30,000 irrigation wells to serve 20 million acres with an annual pumpage of nearly 40 million acre-ft. Detailed hydrologic studies indicated that mild steel would be satisfactory for casing; however, within two years after construc-tion, about 10% of the wells began to fail due to encrustation and corrosion of the casing. A search to find a noncorrosive substitute for the steel casing disclosed that only fiberglass-reinforced plastic pipe satisfied all requirements. The results of initial use of fiberglass have been highly satisfactory and have resulted in a lower over-all well cost. Advances in technology promise further reduction in prices and improvement in per-formance. (Smith-NWWA) W73-14722

THE HORIZONTAL WELL AS A NEW METHOD OF RANGE WATER DEVELOP-MENT, Agricultural Research Service, Tucson, Ariz. For primary bibliographic entry see Field 08B. W73-14729

#### 4C. Effects on Water of Man's Non-Water Activities

AN INTERDISCIPLINARY EVALUATION OF ERTS POTENTIAL FOR ARID REGIONS, Nevada Univ., Reno. Renewable Center. For primary bibliographic entry see Field 07C. W73-14344

GEOGRAPHIC INVESTIGATIONS AS-SOCIATED WITH THE EROS PROGRAM OF THE DEPARTMENT OF THE INTERIOR, Geological Survey, Washington, D.C. Geographic Applications Program. For primary bibliographic entry see Field 07B. W73-14346

ENERGY BUDGET AND PHOTOSYNTHESIS OF CANOPY LEAVES, California Univ., Los Angeles. Dept. of Geography.
For primary bibliographic entry see Field 021.
W73-14358

HIGH YIELD FROM THE BULL RUN WATERSHED, British Columbia Dept. of Municipal Affairs, Vic-toria. Environmental Planning and Management For primary bibliographic entry see Field 02A. W73-14687

#### 4D. Watershed Protection

RUNOFF, EROSION, AND TILLAGE EFFI-CIENCY ON GRADED-FURROW AND TER-RACED WATERSHEDS, Agricultural Research Service, Temple, Tex. Blackland Conservation Research Center. C. W. Richardson.

Journal of Soil and Water Conservation, Vol 28, No 4, p 162-164, July-August 1973. 3 fig, 2 tab, 5

Descriptors: \*Erosion control, \*Terracing, \*Water control, Rainfall-runoff relationships, Soil conservation, Contour furrows, Contour farming, Con-Identifiers: \*Graded furrows.

Runoff, soil loss, and farm tillage efficiencies of a graded-furrow system were compared with those of a terrace system. Runoff was significantly less from the graded-furrow area than from the terraced area, and erosion from the two areas was esseven area, and erosion from the two areas was es-sentially equal. Tillage rates were about 21 percent faster on the graded-furrow area than on the ter-raced area. The graded-furrow system functioned well during an intense storm that caused terrace failure on many adjacent areas. (Knapp-USGS) W73-14410

WATER YIELD AND EROSION RESPONSE TO LAND MANAGEMENT,

Agricultural Research Service, Council Bluffs, Iowa. North Central Watershed Research Center. R. G. Spomer, K. E. Saxton, and H. G. Heinemann.

Journal of Soil and Water Conservation, Vol 28, No 4, p 168-171, July-August 1973. 3 fig, 3 tab, 7

Descriptors: "Water yield, "Sediment yield, "Ero-sion control, "Terracing, "Contour farming, Con-tours, Loess, Land management, Contour fur-rows, Iowa, Topography, Rainfall-runoff relation-ships.

Nearly equal water yields on level-terraced corn Nearry equal water yields on level-terraced corn and contoured-corn watersheds were found in 8 years' observation of five research watersheds. Water yield from a grassed watershed was 37 percent less. Surface runoff was 10 percent of water yield from the terraced watershed and 65 percent yeur from the terraced watershed and os percent of water yield from the contoured watersheds. Peak runoff rates from terraced-corn and grassed watersheds were 10 percent of those from con-toured-corn watersheds. Sheet erosion averaged 24 tons per acre per year on the contoured-corn watersheds and less than 1 ton per acre per year from the terraced-corn watersheds. Gully erosion averaged 450 tons per year from the contoured-corn watershed, but was negligible on the terraced and grassed watersheds. (Knapp-USGS) W73-14411

INFILTRATION, HYDRAULIC CONDUCTIVITY, AND RESISTANCE TO WATER-DROP IMPACT OF CLOD BEDS AS AFFECTED BY CHEMICAL TREATMENT, IOWA State Univ. Ames. Dept. of Soil Science. D. M. Gabriels, W. C. Moldenhauer, and D. Kirkham Soil Science Society of America Proceedings, Vol 37, No 4, p 634-637, July-August 1973. 4 tab, 15

Descriptors: \*Infiltration, \*Soil erosion, \*Impact (Rainfall), \*Erosion control, \*Soil treatment, Soil structure, Soil sealants, Soil stability, Water proofing, Wetting, Wettability. Identifiers: Soil conditioners.

To test the effectiveness of surface treatments in To test the effectiveness of surface treatments in preventing erosion during rainfall, chemicals and bitumen were sprayed on large dry surface clods (8 to 20 mm) and small surface clods (2 to 8 mm) of a Clarion loam. The small clods were initially wetted with 15% water on a soil weight basis and mixed with 13% water on a soil weight oasis and mixed with bitumen emulsions. The large and small clods were subjected to a 6.35-cm-per-hour simulated rainfall. Simultaneously with the measurements of infiltration rate, determinations were made of the starting time for initial runoff, energy needed to in-itiate runoff, runoff rate, total soil loss, and final

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4D—Watershed Protection

soil loss rate. Most of the soil conditioners on large clods kept the infiltration rate high and prevented runoff on a 9% slope. Polyvinyl alcohol and polyacrylamide prevented any soil loss during 90 min. Surface applications with bitumen emulsions were also highly effective in preventing erosion of large clods but were less effective for small clods. When the bitumen emulsions were mixed with the When the bitumen emulsions were mixed with the small clods, the saturated hydraulic conductivity was very high. The infiltration rate was low because water would not enter the clod bed and stable clods were carried in the runoff water. (K-napp-USGS)
W73-14413

MIDDLETOWN STREAMBELT REPORT. Soil Conservation Service, Washington, D.C.

Prepared for the Town of Middletown, Connecticut, published by Eastern Connecticut Resource Conservation and Development Project, March 1973. 25 p., 2 tab, 1 map, append.

\*Streambeds, Descriptors: \*Conservation streams, Banks, Connecticut.
Identifiers: "Streambelts, "Middletown (Conn),
Mattabesset River (Conn), "Connecticut River

The city of Middletown is divided into twenty-three watershed areas. Within the watersheds, streambelts are identified, along with major poten-tial water development sites and other significant features. A streambelt is a corridor which includes a watercourse, floodplains, lakes and ponds as-sociated with the stream, potential water develop-ment sites of public significance, areas in proximity to streams where certain potential land uses would have probable adverse environmental efwould have probable adverse environmental effects, and contiguous lands with special beneficial and environmental values. The study is one phase of inventorying natural resources of the city. It is the result of field reconnaissance and map studies. There is evidence of streambelt encroachment by development. Eleven conditions are identified in which streambelt protection serves the public interest. Among these are protection of areas of vital terest. Among mese are protection of areas of vital importance in the preservation of significant ecological systems; retention of potential impoundment sites for beneficial water uses such as flood control, water supply, wildlife habitat, and recreation; protection of water quality and high siddline standards are seathed. yielding ground water areas that are important to water supply; maintaining a framework of environmental corridors of high quality with close proximity to neighborhood and population centers. (Stein-North Carolina) W73-14484

SOIL EROSION--THE UNMENTIONED POL-LUTER, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 02J.

#### 05. WATER QUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification of Pollutants

SELECTED PESTICIDES IN AQUATIC FUNGI IN THE THREE RIVERS AREA, Michigan State Univ., East Lansing. Dept. of E. S. Beneke, and K. L. O'Donnell.

E. S. Beneke, and K. L. O'Donnell. Available from the National Technical Informa-tion Service as PB-223 372, \$3.00 in paper copy, \$1.45 in microfiche. Institute of Water Research, Michigan State University, Project Completion Report, August 1973. 16 p, 10 fig, 3 tab, 16 ref. OWRR A-057-MICH (1). 14-31-0001-3522.

Descriptors: \*DDT, Dieldrin, Ambient light, \*Aquatic fungi, Metabolism, \*Pesticide resudues, \*Michigan, Protozoa, Monitoring, Pollutant identification. Identifiers: \*Saprolegniaceous fungi, Ciliade protozoan, Fungal inocula, Protozoan inocula, DDT monitors, \*Gas-liquid chromatography, Metabolites, Red Cedar River (Mich), Au Sable River (Mich).

This study.

This study involved the collection and identification of saprolegniaceous fungi in the Red Cedar and Au Sable Rivers. The most common species were studied in the laboratory and in the Red Cedar River to determine their ability to uptake and metabolize DDT. The value of these aquatic fungi as pesticide monitors was also investigated. In addition, the transfer of DDT from aquatic fungi to a cilliated protozoan was studied. No discernible correlation exists between pollution aspects of the habitat and species occurrence of the saprolegniaceous fungi in the Red Cedar and Au Sable Rivers. However, the use of special baits and extensive sampling may yield a technique of greater sensitivity. Dictyuchus monosporus was the most abundant saprolegniaceous species collected during the sampling periods in the Red Cedar and Au Sable Rivers. The use of twigs, leaves, and bottom sediment appears to be a more leaves, and bottom sediment appears to be a more effective method for the isolation of these aquatic effective method for the isolation of these aquatic fungi than the aluminum tea ball method. The four species of aquatic fungi studied, Dictyuchus monosporus, Saprolegnia parasitica, Achlya americana, Aphanomyces sp., were able to concentrate DDT at levels much higher (37.5 to 135 fold within the first 24 hours) than the ambient concentrations in the nutrient media. In addition, Saprolegnia parasitica was able to concentrate DDT by 6.75 fold in soil amended with this pesticide. Tetrahymena pyriformis was able to concentrate this pesiticide by 12 fold over the ambient concentration in the nutrient medium. tration in the nutrient medium W73-14207

AN ASSESSMENT OF AUTOMATIC SEWER FLOW SAMPLERS, FLOW SAMPLERS, Hydrospace-Challenger, Inc., Rockville, Md. P.E. Shelley, and G. A. Kirkpatrick. Copy available from GPO Sup Doc as EP1.23/2:73-261, \$2.60; microfiche from NTIS as PB-223 355, \$1.45. Environmental Protection Agency Technology Series Report EPA-R-2-73-261, June 1973. 233 p. 23 fig, 4 tab, 29 ref. EPA Contract 68.03.0155 ntract 68-03-0155

Descriptors: Automatic control, Pollutants, Hydraulics, \*Sampling, Antomation, \*Flow measurement, Instrumentation, Sewers, \*Storm drains, Storm runoff, Measurement, Water sampling, Design flow, \*Reviews.

Identifiers: \*Combined sewer flows, \*Automatic samplers. samplers.

A brief review of the characteristics of storm and A brief review of the characteristics of storm and combined sewer flows is followed by a general discussion of the purposes for and requirements of a sampling program. The desirable characteristics of automatic sampling equipment are set forth and problem areas are outlined. A compendium of over 60 models of commercially available and custom designed automatic samplers is given with descriptions and characterizations of each unit presented along with an evaluation of its suitability for a storm and/or combined sewer application. A review of field experience with automatic sampling equipment covering problems encountered pling equipment covering problems encountered and lessons learned. A technical assessment of the state-of-the-art in automatic sampler technology, and design guides for development of a new, im-proved automatic sampler for use in storm and combined sewers are presented. (EPA) W73-14221

ABSORPTION ANALYSIS OF PHOSPHATES IN WATER, Wisconsin Univ., Milwaukee. Dept. of Chemistry.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-223 338, \$4.50 in paper copy, \$1.45 in microfiche. Environmental Protection Agency Report EPA-670/2-73-079, October, 1973 35 p, 3 fig, 7 tab, 7 ref. EPA Project 16020 DHD.

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Descriptors: Absorption, \*Phosphates, Water analysis, \*Sulfates, \*Silicates, \*Pollutant identifi-

Identifiers: \*Inhibition titration, \*Atomic absorp-

The project investigated utilization of phosphate, silicate, and sulfate chemical inhibition effects in magnesium atomic absorption spectrometry for the purpose of determination of these anions. The variables found to be of greatest significance in the inhibition processes were flame temperature and solution stoichiometry. The procedure termed 'atomic absorption inhibition titration' (AAIT) was atomic absorption inhibition titration (AAIT) was developed. It provides useful, new determination methods for single anions and also for simultaneous determination of phosphate, silicate, and sulfate in a single sample. The methods have been evaluated and applied to water and waste water samples. (Booth-EPA)
W73-14223

APPLICATION OF OXINE IN THE POLARO-GRAPHIC ANALYSIS OF ORGANOMETALLIC COMPOUNDS. MICRODETERMINATION OF CADMIUM, MAGNESIUM, ZINC, MAN-GANESE, AND COBALT, Institut National des Sciences et Techniques Nucleaires, Saclay (France). S. W. Bishara. Mikrochimica Acta. No 1. n 25-32, 1973, 1 fig. 1 Mikrochimica Acta, No 1, p 25-32, 1973. 1 fig, 1

Descriptors: \*Cadmium, \*Magnesium, \*Zinc, \*Manganese, \*Cobalt, \*Polarographic analysis, Heavy metals, Chemical analysis, Alkaline earth metals, Hydrogen ion concentration, Chemical reactions, Chemical precipitation. Identifiers: \*Organometallics, Oxine, Accuracy,

tab, 12 ref.

A procedure for the microdetermination of Cd, Mg, Zn, Mn, and Co in organometallic compounds is presented. After closed-flask combustion, the metal-oxine complex is precipitated from an am-monia-ammonium chloride buffered medium of pH 10. At this pH value oxine gives a well-defined polarographic wave. The wave height of an exces-sive volume of oxine is measured before and after it has been used to precipitate a known weight of the organometallic compound. The method is sim-ple and rapid; one determination consumes 25 minutes. The average percent error amounts to plus or minus 0.53. (Holoman-Battelle) W73-14248

SEPARATION OF MOLYBDENUM FROM TUNGSTEN, VANADIUM, IRON, URANIUM AND SEVERAL OTHER INTERFERING ELEMENTS BY EXTRACTION OF ITS THIOSULPHATO COMPLEX, Kurukshetra Univ. (India). Dept. of Chemistry. V. Yatirajam, and J. Ram. Mikrochimica Acta, No 1, p 77-86, 1973. 5 tab, 10

Descriptors: \*Separation techniques, \*Molybdenum, \*Solvent extractions, Methodology, \*Polutant identification, Heavy metals, Iron, Titanium, Chromium, Manganese, Cobalt, Nickel, Aluminum, Chemical reactions, Color reactions. Identifiers: \*Metal complexes, \*Metalthiosulphato complexes, Vanadium, Tungsten, Zirconium, Cerium, Uranium, Bismuth, Antimony, Chemical interference.

A sample solution containing 0.8 mg or less Mo/ml, 1.5 N HCl and 32 mg Na2S203.5H20/ml, is shaken with methyl isobutyl ketone at about old degrees. Molybdenum is stripped off the solvent

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants-Group 5A

with ammonia-hydrogen peroxide solution and is determined after the filtration of any insoluble hydroxides and decomposition of hydrogen peroxide and any polythionates. The procedure separates microgram to mg of molybdenum from large amounts of Ti (U), V (V), Cr (VI), Mn (II), Fe (III), Co (II), Ni (II), W (VI), Zr (IV), Ce (IV), U (VI), Bi (V), Sb (III) and Al (III) in a wide variety of samples. (Holoman-Battelle)

MICRO AND SEMIMICRO DETERMINATION OF ARSENATE USING ION-SELECTIVE ELEC-TRODES,
California Univ., Livermore, Lawrence Liver-

W. Selig. Mikrochimica Acta, No 3, p 349-359, 1973. 3 fig. 4 tab. 25 ref.

Descriptors: \*Methodology, \*Pollutant identification, Analytical techniques.
Identifiers: \*Ion selective electrodes, \*Arsenates, Potentiometric titration, Fluoride electrodes, Lead

An indirect method for the microestimation of 0.75 An indirect method for the microestimation of 0.7 to 15 ppm (0.01-0.2 mM) of As (V) has been described: Arsenate is precipitated with lanthanum nitrate at a pH of 8.65. The excess of lanthanum is titrated with standard fluoride, using a fluoride ion-selective electrode. Equivalence points are located on volume-corrected Gran's plot paper. This method can also be used to estimate the sum of arsenate and phosphate. For larger amounts of arsenate and for increased precision and accuracy, potentiometric titration with lead perchlorate, using a lead ion-selective elec-trode, is recommended. Other possibilities for determining arsenate and a method for estimating tungstate are suggested. (Holoman-Battelle) W73-14250

SPECTROPHOTOMETRIC DETERMINATION OF CALCIUM, Upper Iowa Univ., Fayette.

For primary bibliographic entry see Field 02K.

SOME LIMNOLOGICAL CHARACTERISTICS OF THE NOZHA HYDRODROME, NEAR ALEXANDRIA, EGYPT,

Alexandria, Univ. (Egypt). Dept. of Oceanography. M. A. H. Saad.

Hydrobiologia, Vol 41, No 4, p 477-499, May 30, 1973. 3 fig, 6 tab, 47 ref.

Descriptors: \*Limnology, \*Water chemistry, \*Artificial lakes, \*Physicochemical properties, \*Water quality, Water sampling, Water analysis, Chemical analysis, Physical properties, Chemical properties, Secchi disks, Light penetration, Hydrogen ion concentration, Bottom sampling. Dissolved oxygen, Chlorides, Water temperature, Water levels, Air temperature, Suspended solids, Dissolved solids, Africa, Pollutant identification. Identifiers: Nozha Hydrodome, Seasonal varia-tion, Egypt, Chlorosity, Total residue.

Certain limnological characteristics of Nozha Hydrodome, an Egyptian artificial lake, have been died and the data obtained compared with those from the same lake prior to the erection of the high dam south of Aswan. Water samples were col-lected monthly during a 1-yr period for the deter-mination of pH, chlorosity, dissolved oxygen and total residue of the lake water. Light penetration and water temperature were measured at each sampling site. Variations of water level, Secchi disc readings, pH, chlorosity, and total residue are correlated with the introduction of a large amount of fresh Nile water into the lake, to replace that lost mainly by evaporation. Comparison with the

previous data, gave considerable changes. (Holoman-Battelle) W73-14252

ON THE VARIABILITY OF STEPHANODISCUS HANTZSCHII GRUN., (UBER DIE VARIA-RII.ITAT VON STEPHANODISCUS BILITAT VON HANTZSCHII GRUN),

Rostock Univ. (East Germany). Institut fuer Hygiene. L. Kalbe. Hydrobiologia, Vol 42, No 1, p 21-29, July 6, 1973.

Descriptors: \*Systematics, \*Diatoms, \*Ecology,

5 fig, 19 ref.

Benthic flora, Phytoplankton. Identifiers: \*Stephanodiscus hantzschii var. pusil-lus, \*Stephanodiscus hantzschii var. striatior, Warmow River, Malchiner Peene River, Neu-kalener Peene River, Lake Kummerow, \*Ger-

A new variety, striatior, of the diatom Stephanodiscus hantzschii GRUN. (S. h.) with denser striae was described (Kalbe 1971). The validity of S.h. var. pusillus is confirmed by specimens from freshwaters of the north of Mecklenburg. The species S.h. probably consists in this region of several races with different peaks of valve diameter variation. The planktonic mass changing of S.h. and its forms in the three rivers Warnow, Malchiner Peene and Neukalener Peene and in the Lake Kummerow is represented. The and in the Lake Kummerow is represented. The differences of the average valve sizes in these waters are remarkable. Var. pusillus GRUN. appears to be a benthic mass form, too. High cell numbers and high cell volume sums are not developing ever simultaneously. Var. pusillus is not a suitable form for evaluating the saprobiologiand a surface form for evaluating the saprobiological status, for it is adaptable to different ecological conditions. The species S.h. itself is a beta-to alphamesosaprobic organism, being able to produce high cell numbers within this range of saprobity. (Little-Battelle) W73-14236

THE EPIPHYTIC DIATOM FLORA OF THE BENTHIC MACROPHYTE COMMUNITIES ON ROCKY SHORES IN THE SOUTHWESTERN ARCHIPELAGO OF FINLAND, SEILI ISLANDS, Turku Univ. (Finland). Dept. of Botany H. Rautiainen, and O. Ravanko.

Nova Hedwigia, Vol 23, No 4, p 827-842, 1972. 8

Descriptors: \*Diatoms, \*Marine algae, \*Biological communities, Marine plants, Speciation, Systematics, Pondweeds, Chlorophyta, Chrysophyta, Phaeophyta, Rhodophyta, Intertidal areas, Benthic flora, Cyanophyta, Epiphytology, Water sampling, Classification, Statistical methods, Kelps.

Identifiers: \*Epiphytes, \*Macrophytes, Sample preparation, Finland, Seili Islands, Gyrosigma, Licmophora, Rhizosolenia, Surirella gemma, Surirella ovata, Surirella striatula, Potamogeton spp, Cladophora glomerata, Fucus vesiculosus, Pilayel-la littoralis, Ceramium tenuicorne, Calothrix scopulorum, Achanthes spp.

An analysis of the epiphytic diatom flora was carried out in connection with a study of the benthic macrophyte communities in the SW archipelago of Finland, Seili Islands (Ravanko, 1972). Samples were taken from macrophytes collected from quadrats (1 sq m) on 13 lines. Preparations were made by pulverizing and homogenizing the macrophyte material to which was then added strong by device This institute maded. strong hydrogen peroxide. This mixture was allowed to stand 2-3 days at room temperature or 2 lowed to stand 2-3 days at room temperature or 2 days at 40-50C to allow the digestion of organic matter. Test tubes containing the mixture were then centrifuged and the material transferred to a cover glass, dried, and mounted in Clearax for microscopic observations. The diatoms were determined and counted; results relating to the same macrophyte belt were combined. The percentages of each diatom species in the different belts were calculated. The occurrence in the macrophyte belts of diatoms with percentages of five or more is presented in diagrams. No clear zonation of diatoms was distinguished corresponding to the macrophyte belts, but statistical analysis showed that on most lines the macrophyte belts differed from each other in regard to their epiphytic diatom flora. The species composition of the epiphytic diatom flora is discussed and compared with that of other areas. (Holoman-Battelle) W73-14256

EFFECTS OF POLLUTION ON FRESHWATER

FISH, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C. W73-14259

MICROBIOLOGY OF WATER, Environmental Protection Agency, Cincinnati, Ohio. Water Supply Research Lab. For primary bibliographic entry see Field 05B. W73-14260

MICROBIOLOGY-DETECTION OF BACTERI-AL PATHOGENS AND THEIR OCCURRENCE, National Environmental Research Center, Cincinnati. Ohio.

Journal Water Pollution Control Federation, Vol 45, No 6, p 1278-1289, June 1973. 105 ref.

Descriptors: \*Pathogenic bacteria, Distribution, Descriptors: Pranogenic Dacteria, Distribution, Pollutant identification, "Water pollution sources, Water pollution effects, Pollutants, "Isolation, "Reviews, "Microbiology, Arobic bacteria, Anaerobic bacteria, Enteric bacteria, Human dis-Anacrobe Dacteria, Enterior Dacteria, Minima us-cases, Public health, Coliforms, Zoonoses, Domestic wastes, Waste water (Pollution), Animal diseases, Epidemiology, Epizootiology, Widlife, Laboratory animals, Animal wastes (Wildlife), Solid wastes.

Solid wastes.

Identifiers: Enumeration, Serotypes, Recovery, Culture media, Culturing techniques, Enrichment, Biological samples, Environmental samples, Edwardsiella tarda, Sallmonella newington, Salmonella montevideo, Salmonella typhimurium, Salmonella enteritidis, Salmonella anatum, Salmonella derby, Salmonella dublin, Slaughterhouse wastes, Feces, Salmonella aberdeen, Samonella choleraesuis, Simonella bovis-morbificans, Enterphatications

This literature review is concerned with the occurrence of various pathogenic bacteria along with methods for detecting such organisms. (Holoman-Battelle) W73-14263

MICROBIOLOGY-DETECTION AND OCCUR-RENCE OF VIRUSES, National Environmental Research Center, Cincinnati, Ohio.

G. Berg.
Journal Water Pollution Control Federation, Vol
45, No 6, p 1289-1294, June 1973. 45 ref.

Descriptors: \*Viruses, \*Pollutant identification, \*Shellfish, Methodology, \*Bibliography, Waste water (Pollution), Water pollution, \*Public health, Distribution, \*Reviews, Pollutants, Swimmig pools, Water wells, Natural streams, Human diseases, Epidemics, Aquatic environment, Estuarine environment, Equipment, \*Microbiology, Saline water, Permselective membranes, Bacgy, Sanne water, Permseiectuve memoranes, Bac-teriophage, Polyelectrolytes, Oysters, Clams, Potable water, Electro-osmosis, Adsorption, Mus-sels, Flocculation, Caemical precipitation, Hospitals, Reverse osmosis, E. coli, Water pollu-tion effects, Epidemiology, Path of pollutants.

#### Group 5A-Identification of Pollutants

Identifiers: Recovery, Marine environment, Membrane filters, Enteroviruses, Poliovirus 1, Poliovirus 2, Ultrafiltration, Adenoviruses, Celluse acetate, Coxsockie virus B5, Celluse nitrate, Coliphage T2, Reovirus 1, Echovirus 7, Echovirus 11, Echovirus 1, Echovirus 12, Echovirus 14, Echovirus 19, Echovirus 12, Echovirus 14, Echovirus 19, Echovirus 10, Coxsackie virus B1, Coxsackie Vir virus B3, Coxsackie B4, Tissue cultures, Crassos-trea virginica, Pachygraspus, Mytilus californi-anus, Hemigraspus, Coliphage T4, Cancer magister, Cancer antennarius, Infectious hepatitis,

This literature review is concerned with the oc-curence and methods of detecting virus in polluted water and organisms. (Holoman-Battelle)

VERSATILE COMBUSTION-AMALGAMATION TECHNIQUE FOR THE PHOTOMETRIC DETERMINATION OF MERCURY IN FISH AND ENVIRONMENTAL SAMPLES, National Marine Fisheries Service, Ann Arbor, Mich. Great Lakes Fishery Lab. W. A. Willford, R. J. Hesselberg, and H. L. Bergman

Journal of the Association of Official Analytical Chemists, Vol 56, No 4, p 1008-1014, July 1973. 3 fig, 3 tab, 16 ref.

Descriptors: \*Mercury, \*Chemical analysis, Fish, Descriptors: "Mercury, "Chemical analysis, Fish, "Methodology, "Pollutant identification, Plant tis-sues, Sediments, Photometry, Water analysis, Soil analysis, Lake sediments, Heavy metals, Coho salmon, Lake Michigan, Coals, Aquatic plants. Identifiers: "Environmental samples, "Biological samples, Chemical interference, Detection limits, Precision, Sensitivity, Accuracy, Sample size, Sample preparation, Chemical recovery, Amalga-mation, Animal tissues, Reproducibility, Chamical Animal tissues, Reproducibility, Chamical samples, Chamical services, Reproducibility, Chamical samples, Chamical services, Reproducibility, Chamical samples, Chamical services, Reproducibility, Chamical samples, Chamic mation, Animal tissues, Reproducibility, Chara,

Total mercury in a variety of substances is determined rapidly and precisely by direct sample com-bustion, collection of released mercury by amalga-mation, and photometric measurement of mercury volatilized from the heated amalgam. Up to 0.2 g fish tissue is heated in a stream of 02 (1.2 1/min) for 3.5 min in 1 tube of a 2-tube induction furnace. for 3.5 min in 1 tube of a 2-tube induction furnace.

The released mercury vapor and combustion products are carried by the stream of 02 through a series of traps (6 percent NaOH scrubber, water condenser, and Mg (C104)2 drying tube) and the mercury is collected in a 10 mm diameter column of 24 gauge gold wire (8 g) cut into 3 mm lengths. The resulting amalgam is heated in the second tube of the induction furnace and the valustilized mercuof the induction furnace and the volatilized mercury is measured with a mercury vapor meter equipped with a recorder integrator. Total analysis time is approximately 8 min/sample. The detection limit is less than 0.002 microgram and the system is easily converted for use with other biological materials, water, and sediments. Major advantages of the method include: simplicity of operation; speed of complete analysis; high sensitivity, precision, and accuracy; small sample size required; freedom from rigorous and sometimes hazardous acid-digestion procedures; freedom from reagent and glassware contamination; and comparatively low cost of equipment. Disad-vantages of the method include: somewhat limited vantages of the method include: Somewat initied usable range of sensitivity (0.02-5.0 ppm); a general inability to analyze highly contaminated samples (greater than 5.0 ppm) without the use of a gas stream splitter or an extremely small sample; necessity for frequent changes in attenuation of mercury vapor meter, unless previous knowledge permits grouping of samples within ranges having less than a 5-fold difference inconcentration; and increased emphasis on the need for well homogenized representative samples. Minor changes in the system or substitution of a less sensitive mercury vapor meter would overcome many of these disadvantages when they are restrictive for a particular use. (Holoman-Battelle) W73-14271

RETENTION OF MERCURY WHEN FREEZE-DRYING BIOLOGICAL MATERIALS, National Bureau of Standards, Washington, D.C. Analytical Chemistry Div. P. D. LaFleur.

Analytical Chemistry, Vol 45, No 8, p 1534-1536, July 1973. 5 tab, 6 ref.

Descriptors: "Mercury, "Radioactivity techniques, Aqueous solutions, Heavy metals. Identifiers: "Biological samples, "Freeze drying, "Feces, Methylmercuric chloride, Sample preparation, Phenylmercuric acetate, Chemical recovery, Precision, Tissue, Muscle, Blood, Liver, Brain, Kidneys, Heart, Organomercury compounds, Methylmercury, Lyophilization.

Guinea pigs and rats were fed foods containing Hg-203 labelled phenylmercuric acetate, methylmercury chloride, or inorganic mercury for use in tests to determine whether mercury losses occur during lyophilization (freeze drying) of biological samples. Upon sacrifice, the animals were dissected, and the liver, kidney, heart, brain, muscle, spleen and samples of blood taken for study. Feces were also collected during the feeding regimen. The samples were weighed, the relative mercury content determined radiometrically, and frozen. The samples were then lyophilized and the mercury content was again determined radiometrically. Net loss of mercury was calculated after cally. Net loss of mercury was calculated after making appropriate decay corrections. Of a total of over 30 tissue samples from animals fed methylof over 30 tissue samples from animals fed methyl-mercury chloride, the mean mercury loss was less than 3 percent. Of the 10 organ samples from animals fed inorganic mercury and 11 tissue sam-ples from those fed phenylmercuric acetate, the mean loss was less than 2 percent. Loss from blood was negligible, loss from feces was approxi-mately 10 percent. Additional tests to determine the effects of pretreatment by freezing and time of leaphilization showed that neither affected loss of lipophilization showed that neither affected loss of mercury. Freeze drying of aqueous solutions resulted in losses up to 90 percent for the organomercurials and 10 percent for inorganic mercury. (Little-Battelle) W73-14272

COLLABORATIVE STUDY OF THE RECOVERY AND GAS CHROMATOGRAPHIC QUANTITATION OF POLYCHLORINATED BIPHENYLS IN CHICKEN FAT AND POLYCHLORINATED BIPHENYL-DDT COM-BINATIONS IN FISH, Food and Drug Administration, Minneapolis,

Minn.

.. D. Sawyer. Journal of the Association of Official Analytical Chemists, Vol 56, No 4, p 1015-1023, July 1973. 6 tab, 13 ref.

Descriptors: \*Polychlorinated biphenyls, \*Poultry, \*Fish, \*DDT, \*Chemical analysis, Chlorinated hydrocarbon pesticides, Methodology, DDE, DDD, Pesticide residues. Identifiere: Animal statements of the control o

gy, DDE, DDD, Pesticide residues. Identifiers: Animal tissues, \*Electron capture gas chromatography, Chemical recovery, \*Fat tissue, Quantitative analysis, Interlaboratory studies, Isomers, Aroclor 1260, Aroclor 1254, Aroclor 1260, Torolor 1254, Popio 1242, Gas liquid chromatography, Collaboratove studies, Precision, Animal fat, Sample preparation, p p DDE, p p TDE, p p DDT, o p DDT, Biological samples.

Nine laboratories collaborated on the analyses of PCBs in chicken fat and DDT-PCB combinations in fish. Existing AOAC multipesticide methodology with GLC quantitation was employed. On in tish. Existing AOAC multipesticide methodology with GLC quantitation was employed. One solution containing a mixture of Aroclors 1254 and 1260 was analyzed by GLC only. The fish samples were subjected to a published silicic acid procedure for separating the DDT-PCB mixtures. The DDT analogs were quantitated before and after the separation. The PCB content was quantitated by total peak height and total area com-parisons against appropriate Aroclor (s), using electron capture GLC, and additionally in 6

laboratories by total area comparisons, using halogen-specific detection. The electron capture GLC data demonstrated better accuracy and preci-GLC data demonstrated better accuracy and precision. The following PCB recoveries were obtained by using total peak height comparisons: 5 ppm mixed Aroclor solution, 100 plus or minus 4 percent; 8 ppm Aroclor 1242-fortified chicken fat, 101 plus 13 percent; 7.5 ppm Aroclor 1248-fortified chicken fat, 96 plus or minus 9 percent; incurred Aroclor 1242 chicken fat, 9.2 ppm plus or minus 8 percent; 6 ppm Aroclor 1254-fortified fish, 75 plus or minus 14 percent; 6 ppm Aroclor 1260-fortified fish, 75 plus or minus 15 percent; and an environmentally incurred residue in fish, 4.5 ppm plus or minus 20 percent. The 2 Aroclor-fortified fish samples were concurrently spiked with the p.p. ples were concurrently spiked with the p.p'-isomers of DDE, TDE, and DDT at levels of 4, 1, isomers of DDE, TDE, and DDT at levels of 4, 1, and 3 ppm, respectively. After silicic acid separation the combined recoveries for these 2 samples were: DDE, 86 plus or minus 13 percent; TDE, 89 plus or minus 20 percent; and DDT 84 plus or minus 17 percent. Environmentally incurred-DDT residues were recovered at 4.1 ppm plus or minus 14 percent for p, DDE, 0.7 ppm plus or minus 24 percent for o, p-DDT and 2.7 ppm plus or minus 17 percent for p p-DDT. The DDT values calculated before the silicic acid separation compared favorably with those summarized. The mullated before the since acid separation compared favorably with those summarized. The multiresidue method for chlorinated pesticides, 29,001-29,027., has been adopted official first action to include polychlorinated biphenyls in poultry fat and fish. (Holoman-Battelle)

LIQUID CHROMATOGRAPHY-MASS SPEC-TROMETRY. COUPLING OF A LIQUID CHRO-MATOGRAPH TO A MASS SPECTROMETER, Georgia Univ., Athens. Dept. of Biochemistry.
R. E. Lovins, S. R. Ellis, G. D. Tolbert, and C. R. McKinney. Analytical Chemistry, Vol 45, No 8, p 1553-1556, July 1973. 8 fig, 7 ref.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Laboratory equipment, \*Pollutant identification, DDT, DDD, Dieldrin, \*Chromatography, \*Mass BDI, DDB, Bletin, Commongraphy, Mass spectrometry, Instrumentation, Design. Identifiers: Liquid chromatography, LC-mass spectrometry, Sulfathiazole, Sulfamilamide, Sulfamethazine, Anthraceine, Pyrene, Chrysene, Naphthalene, Chromatograms.

Because of the increasing utility of liquid chromatography in analytical and bio-analytical problems, the need for a reliable method of analyzing and identifying the effluent peaks generated by the liquid chromatograph has become apparent. For this purpose a system was designed to couple the liquid chromatograph to a mass spectrometer. The interface consisted of a motor driven probe to accept the effluent peaks mass spectrometer. The interface consisted of a motor driven probe to accept the effluent peaks from a liquid chromatograph, separate the solute from the solvent by flash evaporation in the probe tip, and automatically insert the isolated material into the ion source of the mass spectrometer for analysis. Results are given for the analysis of diedrin, DDT, DDD, sulfathiazole, sulfamilamide, sulfamethazine, anthracene, pyrene, chrysene, and aphthalene. (Little-Battelle) W73-14274

ASBESTOS FIBERS IN BEVERAGES, DRINK-ASBESTOS FIBERS IN BEVERAGES, DRINKING WATER, AND TISSUES: THEIR PASSAGE
THROUGH THE INTESTINAL WALL AND
MOVEMENT THROUGH THE BODY,
Department of National Health and Welfare, Ottawa (Ontario). Food and Drug Research Lab.
H. M. Cunningham, and R. D. Pontefract.
Journal of the Association of Official Analytical
Chemistr. Vol. 55. No. 4. 976. 981 Luly 1073. 4 fia Chemists, Vol 56, No 4, p 976-981, July 1973. 4 fig, 4 tab, 11 ref.

Descriptors: \*Asbestos, \*Electron microscopy, \*Foods, \*Rain, \*Potable water, Rivers, Neutron activation analysis, Separation techniques, Water

pollution effects, Water pollution sources, Air, Air pollution, Water analysis, Snow, Path of pollutants, Distribution, Canada.

Identifiers: \*Biological samples, Tissue, Blood, Spleen, Liver, Kidney, Omentum, Muscle, Lung, Brain, Soft drinks, Beer, Wine, Ottawa River, Sample preparation.

Methods were developed using an electron microscope to isolate and count asbestos fibers in liquids and tissues, Fibers were detected in beer, sherry, port, vermouth, soft drinks, and city drinking water at levels generally ranging from 1 to 11 million per liter. River water was higher in asbestos fibers than water passed through a city filtration system, and melted snow was considerably higher than river water. Asbestos fibers were also detected in parenteral solutions. Distribution studies on asbestos fibers administered to rats were performed with the electron microscope and were supplemented with studies using both tritiated and neutron-activated asbestos. Crysotile fibers were injected into the stomachs of rats and 2-4 days later fibers were isolated from the blood spleen, liver, kidney, omentum, muscle, lung, and brain. Highest levels of orally administered fibers were found in the omentum; intravenously injected fibers resulted in highest levels in the liver and the lung. (Little-Bat-W73-14275

QUANTITATIVE PERCHLORINATION OF POLYCHLORINATED BIPHENYLS AS A METHOD FOR CONFIRMATORY RESIDUE MEASUREMENT AND IDENTIFICATION. Food and Drug Administration, Washington, D.C. Div. of Chemical Technology.

J. A. Armour. Journal of the Association of Official Analytical Chemists, Vol 56, No 4, p 987-993, July 1973. 3 fig, 4 tab. 10 ref.

Descriptors: \*Polychlorinated biphenyls, \*Pollutant identification, \*Chemical analysis, Methodology, Chemical reactions, Poultry, \*Gas

chromatography.
Identifiers: \*Perchlorination method, Electron capture gas chromatography, Derivatives, Mixtures, \*Quantitative analysis, Sample preparation, Decachlorobiphenyl, Chemical recovery, Aroclor 1242, Aroclor 1016, Aroclor 1248, Aroclor 1254, Aroclor 1260, Aroclor 1262, Chubs, Sturgeon, Animal tissues, Eggs, Fat, Sensitivity, Gas liquid chromatography.

The perchlorination procedure for derivatization of PCBs described by Berg, Diosady, and Rees has been modified to achieve a micro-scale quantitative conversion (greater than 90 percent) of commercial PCB preparations (Aroclors) to decachlorobiphenyl. Cleaned up sample extracts containing PCB residues (1-20 micrograms) are allowed to react with antimony pentachloride in the presence of chloroform to form decachlorobiphenyl. This procedure converts a multicomponent mixture to a single derivative detectable by electron capture GLC, thus providing an easy method for quantitating and identifying PCB residues and at the same time increasing the sensitivity of de-tection. The usefulness of the perchlorination procedure is demonstrated by comparing results for environmentally contaminated samples quan-titated by 2 methods: by measuring the total area of the electron capture response for the residue against the Aroclor it most closely resembles, and by measuring the single peak of the decachlorobiphenyl derivative and expressing the results in terms of the particular Aroclor. (Homoman-Battelle) W73-14276 POLYCHLORINATED TERPHENYLS AS POTENTIAL CONTAMINANTS OF ANIMAL

POTENTIAL
PRODUCTS,
Agricultural Research Service, Beltsville, Md.
Agricultural Environmental Quality Inst.
G. F. Fries, and G. S. Marrow.
Journal of the Association of Official Analytical
Chemists, Vol 56, No 4, p 1002-1007, July 1973. 5

Descriptors: "Milk, "Silage, "Pollutant identifica-tion, "Chemical analysis, Sealants, Pollutants, Solvent extractions," Gas chromatography. Identifiers: "Pollychlorinated terphenyls, Electron capture gas chromatography, Aroclor 5460, Sam-ple preparation, Chemical recovery. Tetradecachloroterphenyls, Chemical inter-ference, Gas liquid chromatography, Cleanup, Derivatives.

Evidence is presented of the presence of polychlorinated terphenyl (PCT) residues in samples of wall scrapings, silage and milk from farms where the PCT, Aroclor 5460 has been used in a sealant for concrete stave silos. Milk end silage samples were extracted and cleanup up using FDA multipesticide residue methodology; wall samples were extracted and cleanup up using FDA multipesticide residue methodology; wall scrapings and the sealant sample were extracted and diluted, respectively, with hexane and examined by electron capture GLC without further cleanup. The cleaned up samples were chlorinated with SbC15 to form the 3 tetradecachioroterphenyl derivatives which facilitates identification of PCT residues by electron capture GLC. This work demonstrates that milk produced on farms with contaminated silos will contain PCT residues. Since the PCB and PCT residues are from the same source, correction of the PCB problem will also eliminate the PCT residues. The silo situation does provide good opportunity to study the com-parative behavior of the 2 classes of compounds parative benavior of the 2 classes of compounds under environmental conditions. If the behavior is similar, it may be possible to predict the distribution and levels of PCT residues from information available on PCBs. (Holoman-Battelle) W73-14277

MODIFICATIONS OF THE TECHNIQUE FOR DIFFERENTIATING CULTURES ISOLATED BY OFFICIAL AOAC SALMONELLA

THE OFFICIAL AOAC SALMONELLA METHOD). Food and Drug Administration, Washington, D.C. Div. of Microbiology. P. L. Poelma, and A. Romero. Journal of the Association of Official Analytical Chemists, Vol 56, No 4, p 1027-1028, July 1973. 3

Descriptors: \*Salmonella, \*Pollutant identifica-tion, \*Methodology, \*Separation techniques, \*Cultures, Pathogenic bacteria, Aerobic bacteria, Isolation, Coliforms.

Identifiers: \*Culturing techniques, \*Arizona cul-tures, Selective media, Culture media.

Modifications are suggested for the official AOAC Salmonella method, 41,024-41,040, by which all colonies picked from selective plates are subcultured in both triple sugar and lysine iron agars. The techniques will detect Salmonella and Arizona cultures which might have been discarded. The revisions have been incorporated into the official method. (Holoman-Battelle)

COBALT INTERFERENCE IN THE NON-COBALT INTERFERENCE IN THE NON-STEADY STATE CLEAN WATER TEST, Camp, Dresser and McKee, Boston, Mass. A. A. Kalinske, L. D. Lash, and G. L. Shell. Water and Sewage Works, Vol 120, No 7, p 54-59, July 1973. 11 fig, 4 ref.

Descriptors: \*Cobalt, \*Dissolved oxygen, \*Chemical analysis, \*Water analysis, Heavy metals, Aeration, Methodology, Water quality, Water pollution, Cations, Laboratory tests.

Identifiers: \*Ionic interference, \*Chemical inter-ference, \*Winkler method, Error sources, Nondy state reoxygenation test, Oxygen diffusion

The purpose of this study was to evaluate the non-steady state method for determining oxygen transfer by aeration. It was observed that when sodium sulfite was used to deoxygenate the test water more than 0.05 mg/l cobalt ion concentration caused a chemical interference in the Winkler dissolved oxygen determination. This chemical interference varied with the cobalt ion concentraterference varied with the cobalt ion concentra-tion, the number of sulfite additions, the aeration period between tests and C sub's (saturation value for oxygen under test conditions). Values of ox-ygen input efficiency reported for aerators tested with cobalt ion concentrations greater than 0.05 and the property of the property mg/l can be high by as much as 10 to 50 percent. The degree of error will depend on the amount of cobalt ion used and the number of sulfite additions. If higher cobalt ion concentration is used. then the dissolved oxygen must be measured using a fast response dissolved oxygen probe. A meter which achieves 99 percent of the true value in 15 seconds (after swinging full scale) should be satisfactory. Cobalt interference in the determina-tion of dissolved oxygen (Winkler method) in the non-steady state reoxygenation method may be reduced to insignificant levels by use of no higher than 0.05 mg/1 cobalt ion. (Holoman-Battelle) W73-14281

A RAPID, SENSITIVE METHOD FOR THE DETERMINATION OF THE CHEMICAL OXYGEN DEMAND OF POLLUTED WATERS, Oak Ridge National Lab., Tenn. W. W. Pitt, S. Katz, and L. H. Thacker.

In: Water-1972, AIChE Symposium Series, No. 102 Val

129, Vol 69, p 1-5, 1973. 2 tab, 8 ref, append.

Descriptors: \*Chemical oxygen demand, \*Water pollution, \*Methodology, \*Water analysis, \*Chemical analysis, Waste water (Pollution), Organic compounds, Industrial wastes, Sewage effluents, Treatment facilities, Oxidation, Linear alkylate sulfonates, Natural streams. Identifiers: "Cerate oxidation method, Acetic acid, Acetone, Benzene, Glucose, Ethanol, Glycine, Pyridine, Sodium lauryl sulfate.

A rapid, sensitive cerate oxidation method for measuring the chemical oxygen demand (COD) of waters is described. The pollutants are oxidized with perchloratocerate reagent, and the resulting cerium (III) is determined fluorometrically. Analysis requires only a few minutes for determinations at levels as low as 100 micrograms oxygen demand per liter. Results of tests on solutions of known organic compounds, an industrial waste stream, a ganic compounds, an industrial waste stream, a domestic sewage plant effluent, and a natural stream show that the method compares favorably with the dichromate reflux procedure recom-mended by APHA. However, the new method is considerably faster and easier to use, and is a hundred times more sensitive. An analytical system which is suitable for use as either a continuous COD monitor or as an analyzer for multiple sam-ples in series is also described. (Holoman-Battelle) W73-14283

BIOLOGICAL EFFECTS OF COOLING TOWER BLOWDOWN.

nal Environmental Research Center, Corvallis, Oreg. For primar W73-14285 ary bibliographic entry see Field 05C.

THERMAL REMOTE SENSING ON THE MIS-SISSIPPI RIVER IN IOWA,

Geological Survey, Iowa City, Iowa. S. J. Tuthill, J. V. Taranik, and B. E. Hoyer. In: Water-1972, AIChE Symposium Series No 129, Vol 69, p. 391-400 1973. 10 fig. 2 tab, 1 ref.

#### Group 5A-Identification of Pollutants

Descriptors: "Water temperature, "Remote sensing, "Mississippi River, River systems, Surface waters, Automation, "Thermal pollution, Telemetry, Aerial photography, Water pollution effects, Air temperature, Isotherms, Humidity, Wind velocity, Distribution, Data collections, Calibrations, Density, "Iowa.

Cantorations, Pensity, 1998.

[dentifiers: \*Thermal mapping, \*Thermal infrared imagery, Accuracy, Isothermal maps, Isodensitracing, Thermal line scanner, Radiometers, Wind direction, Radiant energy, Ground truth data. Thermal limasing.

On 4 June, 1971, the Iowa Conservation Commission, Commonwealth Edison, and the Iowa Geological Survey studied the surface temperature distribution of the Mississippi River bordering Iowa. Airborne thermal mapping data were collected along a 180-mile length of river concurrent with surface measurements at 13 preselected areas. Density slicing the thermal imagery provided a method for generating an isothermal map. Results indicate further refinement of thermal mapping techniques could rapidly produce accurate thermal maps for complete river systems. (Holoman-Battelle)

ATOMIC ABSORPTION ANALYSIS OF STRONG HEAVY METAL CHELATING AGENTS IN WATER AND WASTE WATER, Missouri Univ., Columbia. Dept. of Chemistry. R. Kunkel, and S. E. Manahan. Analytical Chemistry, Vol 45, No 8, p 1465-1468, July 1973. 4 fig, 2 tab, 6 ref.

Descriptors: "Heavy metals, Waste water (Pollution), "Pollutant identification, "Chemical analysis, "Methodology, Water analysis, Nitrilotriactic acid, Water pollution, Chelation, Water pollution effects, Pollutants, Sewage effluents, Copper, Potable water, Activated sludge, Brines. Identifiers: "Chelating agents, "Atomic absorption spectrophotometry, Natural waters, Chemical recovery, EDTA, Metal chelates, Ionic interference, Pollutant effects, Solubilization, Metal complexes, Chemical interference, Ammonium.

A method for the analysis of total strong heavy metal chelating agents in water is described. The method is based upon the solubilization of copper by the chelating agents at pH 10 followed by filtration and atomic absorption analysis of soluble copper in the filtrate. The analysis gives total levels of strong chelating agents, a significant parameter insofar as the properties of natural waters and waste waters are concerned. The method is simple, sensitive, and relatively free of interferences. It can be applied to the analysis of individual chelating agents after separation. (Holoman-Battelle)

INTERFERENCES IN NICKEL DETERMINA-TIONS BY ATOMIC ABSORPTION SPEC-TROMETRY, California Univ., Los Angeles. Dept. of Chemis-

try. For primary bibliographic entry see Field 02K. W73-14288

ESTIMATING INDUSTRIAL WATER POLLU-TION IN SMALL REGIONS, Livingston Coll., New Brunswick, N.J. M. R. Greenberg, and R. Zimmerman. Journal Water Pollution Control Federation, Vol

Journal Water Pollution Control Federation, Vol 45, No 3, p 462-469, March 1973. 3 tab, 24 ref, append. OWRR-C1629 (no. 3147) (3). 14-13-0001-3147.

Descriptors: \*Model studies, \*Industrial wastes, Water pollution, \*Estimating, \*Regional analysis, \*Pollutant identification, Surveys, Mathematical models, Mathematical studies, Pollutants, Data collections, Food processing industry, Textiles, Pulp and paper industry, Chemical industry, Oil industry, Tannery wastes, New York, Flow, Biochemical oxygen demand, Suspended solids, Chemical oxygen demand, Dissolved solids, Phenols, Nitrogen, Ammonia, Sulfides, Acidity, Hardness (Water), Proteins, Fluorides, Phosphorus, Chlorides, Halides, Chromium. Identifiers: Data interpretation, Metals industry, Grease, Volatile solids, Tin, Lubricating oils, Sulfuric acid, Hydrochloric acid, Iron Sulfate, Iron chloride, Cyanides.

Estimating industrial water pollution requires information on present levels of pollution and behavioral factors likely to bring about changes in the future. A model covering 26 pollution parameters was calibrated from readily available data for 2,026 plants in the New York region. The simulations produced a microspatial scale view of industrial pollution potential. Attempts to improve the model by collecting regional industrial surveys and questionnaires proved unrewarding because data remained incomplete and inconsistent with respect to location and timing of samples. The potential impact of federal regulations and technological changes on industrial effluent generation will be influenced largely by the organizational structures governing the abatement program. (Holoman-Battelle)

MICROANALYSIS WITH THE AID OF ION EXHANGE RESINS. XXVI. DETECTION OF SMALL QUANTITIES OF COPPER (II) WITH BATHOCUPROINE DISULFONATE, MIKROANALYSE MIT HILFE VON IONENAUSTAUSCHERN. XXVI NACHWEIS GERINGER MENGEN KUFFE R (II) MIT BATHOCUPROINDISULFONAT, Hokkaido Univ., Sapporo (Japan). Dept. of Chemistry. T. Takahashi, T. Imamura, and M. Fujimoto. Mikrochimica Acta, No 1, p 69-76, 1973. 5 tab, 10

Mikrochimica Acta, No 1, p 69-76, 1973. 5 tab, 10 ref.

Descriptors: \*Copper, \*Pollutant identification,

Descriptors: Copper, "Poutuant identification, Ion exchange, Iron, Cobalt, Nickel, Zinc, Molybdenum, Bromides, Nitrates, "Chemical analysis. Identifiers: "Ion exchange resins, Detection limits, Trace levels, Ionic interference, Tungsten, Bathocuproine disulfonate.

A new resin spot test with bathocuproine disulfonate for the specific detection of ng amounts of copper (II) is described. Using 1 grain of white strongly basic popcorn-resin, Diaion PA 3-series, the identification limit for copper is 10.4 ng in 10 microliters solution (1: 1,000,000). (Holoman-Battelle) W73-14290

THE MAYFLY (EPHEMEROPTERA) IN TROUT STREAMS OF THE BESKIDS. II. PRODUCTION, DIE EINTAGSFLIEGEN (EPHEMEROPTA) IN FORELLENBACHEN DER BESKIDEN. II. PRODUKTION), Brno Univ. (Czechoslovakia). Zoological Inst.

Brno Univ. (Czechoslovakia). Zoological Inst. M. Zelinka.

Hydrobiologia, Vol 42, No 1, p 13-19, July 6, 1973. 5 tab. 6 ref.

Descriptors: \*Mayflies, \*Secondary productivity, \*Water quality, \*Biomass, \*Animal populations, Streams, Water temperature, Hydrogen ion concentration, Acidity, Alkalinity, Hardness (Water), Calcium, Magnesium, Dissolved oxygen, Ammonia, Nitrates, Nitrites, Phosphates. Identifiers: Baetis rhodani, Rhithrogena semicolorata, Ecdyonurus, \*Czechoslovakia.

The first part of this study (1969) dealt with the abundance and biomass of mayflies (Ephemeroptera). On the basis of the measurement of length of all mayflies and of the determination of the respec-

tive weight (according to the curve expressing the relation length: weight) the production for each month was calculated. The annual average for Rhithrogena semicolorata 12,478 and for the species belonging to the genus Ecdyonurus 8.47 gyaq m. The relation between the annual production and average annual biomass was nearly the same is all three species equal to 1:8.37. These three taxa formed 76 percent of the biomass. After addition of the remaining taxa of mayflies the production of Ephemeroptera in the two brooks under investigation totalled 27, 152 g/sq m equal to 271,52 kg/haper year. Water quality characteristics are tabulated for the streams. (Little-Battelle)

PRELIMINARY SURVEY OF MERCURY AND OTHER METALS CONTAINED IN ANIMALS FROM THE FRASER RIVER MUDELATS, British Columbia, Univ., Vancouver. Inst. of Oceanography. For primary bibliographic entry see Field 05B. W73-14293

RAPID, SELECTIVE METHOD FOR LEAD BY FORCED-FLOW LIQUID CHROMATOGRAPHY, Ames Lab., Iowa.
M. D. Seymour, and J. S. Fritz.
Analytical Chemistry, Vol 45, No 9, p 1632-1636, August 1973. 6 fig, 1 tab, 10 ref.

Descriptors: \*Lead, \*Separation techniques, \*Aqueous solutions, \*Pollutant identification, Heavy metals, \*Anion exchange, Chemical analysis, Methodology, Selectivity, Ions, Nitrates, Molybdenum, \*Chromatography. Identifiers: Forced-Iow liquid chromatography, Environmental samples, Accuracy, Precision, Chemical interference, Ionic interference, Rhodium, Antimony, Sample preparation, Rare earth elements.

A forced-flow ion exchange method for the separation of lead from metal ions has been described. Lead is measured in a manner similar to that described previously for iron. Lead (II) is retained on a small anion exchange column from 0.5 M hydrochloric acid and separated from many other metal ions. Then it is eluted with 8 M hydrochloric acid and the elution curve is recorded at 270 mm. The amount of lead is obtained from a plot of elution peak height vs. micrograms of lead. The entire separation sequence required only 8 min. There are two kinds of interference common to this type of analysis. Column overloading can cause alteration of peak shape and retention time and, hence, a dependency of peak height on matrix composition. The other type of interference is due to ions that are retained in 0.5 M HCl, stripped in 8.0 M HCl and absorbed at 270 nm. Of the cations tested, only three were found to interfere. Rhodium (III), antimony (V), and molybdenum (VI) were found to cause a 1 percent error in the analysis with metal/lead ratios of 0.009, 0.181, and 5.30, respectively. Nitrate ion can also cause error and should be driven off by taking the sample to dryness in concentrated hydrochloric acid prior to analysis. Several standard samples have been successfully analyzed for lead. (Holoman-Battelle) W73-14295

DIRECT DETERMINATION OF PHOSPHORUS BY ATOMIC ABSORPTION FLAME SPEC-TROMETRY, Imperial Coll. Of Science and Technology, London (England). Dept. of Chemistry.

(England). Dept. of Chemistry. G. F. Kirkbright, and M. Marshall. Analytical Chemistry, Vol 45, No 9, p 1610-1613, August 1973. 1 fig, 3 tab, 13 ref.

Descriptors: \*Phosphorus, \*Pollutant identification, \*Aqueous solutions, \*Chemical analysis, Methodology, Nutrients. Identifiers: \*Atomic absorption spec-trophotometry, Detection limits, Chemical inter-ference, Yeast extract, Sensitivity, Accuracy, Molybdenum blue method, Beef extract, Biologi-cal samples, Milk products.

The direct determination of phosphorus by atomic absorption spectrometry at its 177.5-, 178.3-, and 178.8-nm resonance lines using a nitrogen-separated nitrous oxide-acetylene flame and a microwave-excited phosphorus electrodeless discharge lamp source is described. Phosphorus may be determined in aqueous solution as o-phosphate with a sensitivity of 4.8 and 5.4 micrograms/ml (for 1 percent absorption) at the 177.5-and 178.3-am lines; the corresponding detection limits obtained at these wavelengths were 29 and 21 micrograms/ml, respectively. The high temperature and relatively transparent nature of the fuel-rich flame make it a convenient atom cell for the atomization of phosphorus; no significant chemical or physical interferences have been observed at the levels investigated. The results of a preliminary investigation of the application of the method to the direct determination of phosphorus in milk powder and yeast and beef extracts are in milk powder and yeast and beef extracts are described. (Holoman-Battelle) W73-14296

ROLE OF SOLVENT EXTRACTION PARAMETERS IN GOVERNING THE POTENTIAL SELECTIVITY OF LIQUID MEMBRANE ELEC-TRODES, Uppsala Univ. (Sweden). Dept. of Analytical

Chemistry.

ry bibliographic entry see Field 02K.

DETERMINATION OF **AMMONIA** AQUARIA AND IN SEA WATER USING THE AMMONIA ELECTRODE, New England Aquarium, Boston, Mass.
T. R. Gilbert, and A. M. Clay.
Analytical Chemistry, Vol 45, No 9, p 1757-1759, August 1973. 1 fig, 3 tab, 7 ref.

Descriptors: \*Ammonia, \*Water analysis, \*Sea water, \*Aquaria, \*Pollutant identification, Chemical analysis, Aqueous solutions, Pollutants, On-site investigations, Water quality, Water pollution, \*Electrodes.

Identifiers: Ammonia electrodes, Ion selective electrodes, Precision, Reproducibility, Accuracy.

An ammonia electrode that has been fabricated for the analysis of ammonia in aqueous solutions con-sists of a hydrophobic gas-permeable membrane which separates the alkaline test solution from an internal solution 0.1 M in ammonium chloride. When the electrode is immersed in an alkaline test solution, ammonia can diffuse across the mem-brane, alter the NH3 concentration in the filling solution, and so cause a pH change which is moni-tored by the glass electrode. Electrode reproducibility was evaluated using samples from different marine life display tanks at the New England Aquarium with varying ammonia levels. The results indicate that the relative precision of these analyses was fairly constant over a wide concentration range. To test the accuracy of the method and to evaluate the electrode/portable unit as a tool for on-site analysis, a series of 1-liter samples of Boston Harbor water was collected. A Dorchester Bay sample was analyzed on site using the standard procedure described above with a the standard procedure described above with a battery powered magnetic stirring motor. With the meter in a horizontal position to minimize needle oscillation due to rocking of the boat, six analyses of the sample gave a mean value of 92 ppb NH3-N with a standard deviation of 3 ppb. Other samples were acidified to pH 3-4 with 6 M HCl to stabilize the ammonia and analyzed the same day in the laboratory by the electrode and also by the phenol-hypochlorite method. The data indicate that the electrode provides an accurate means of analyzing strengistic area water and that if a warelly more provided to the same accurate means of analyzing strengistic area water and that if a warelly more provided to the same accurate means of analyzing strengistic area water and that if a warelly more provided to the same water and that if a warelly more provided to the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warelly more than the same water and that it is warely more than the same water and that it is warely more than the same water and that it is warely more than the same water and that it is warely more than the same water and that it is warely more than the same water and electrode provides an accurate means of analyzing ammonia in sea water and that it is usually more

precise than the spectrophotometric method. Furthermore, the performance of the electrode in the field is comparable to that observed in the laboratory, showing the technique to be well suited for field analysis. (Holoman-Battelle) suited for fi W73-14298

ENVIRONMENTAL ANALYSIS PROBLEMS CREATED BY UNEXPECTED VOLATILE BERYLLIUM COMPOUNDS IN VARIOUS SAM-

Aerospace Research Labs., Wright-Patterson AFB, Ohio.

For primary bibliographic entry see Field 02K. W73-14299

1-EPHEDRINE IN CHLOROFORM AS A SOL-VENT FOR SILVER DIETHYLDITHIOCARBA-MATE IN THE DETERMINATION OF AR-SENIC, National Environmental Research Center, Cincin-

Analytical Chemistry, Vol 45, No 9, p 1786-1787, August 1973. 1 fig, 2 tab, 2 ref.

Descriptors: \*Colorimetry, \*Solvents, \*Water analysis, Rivers, Sewage effluents, Waste water (Pollution), Odor, Absorption, Spectrophotometry.

Identifiers: \*Arsenic, Sample preparation, Chemical interference, Accuracy, Acid digestion, Or-

1-EPHEDRINE IN CHLOROFORM WAS SUB-STITUTED FOR PYRIDINE AS A SOLVENT FOR SILVER DIETHYLDITHIOCARBAMATE IN THE COLORIMETRIC DETERMINATION OF ARSENIC IN WATER. This eliminates the objectionable odor associated with pyridine. Samples of river water, sewage effluent, and distilled water were analyzed by both procedures and the results compared. 1-ephedrine in chloroform gave an accuracy within the acceptable range. Cr, Co, Cu, Hg, Ni, Pt, and Sb may interfere with the method. However, levels normally encountered do not cause significant interference. As with the pyridine method, organically bound arsenic cannot be determined without an acid digestion step. (Little-Battelle)

PREPARATION AND PROPERTIES OF THE SULFATE ION SELECTIVE MEMBRANE ELECTRODE,

State Univ. of New York, Buffalo. Dept. of Chemistry. For primary bibliographic entry see Field 02K. W73-14301

ULTRAPURIFICATION OF WATER ELECTROCHEMICAL AND SURFACE CHEMI-CAL WORK BY CATALYTIC PYRODISTILLA-

TION,
Ottawa Univ. (Ontario). Dept. of Chemistry.
B. E. Conway, H. Angerstein-Kozlowska, W. B.
A. Sharp, and E. E. Criddle.
Analytical Chemistry, Vol 45, No 8, p 1331-1336,
July 1973. 7 fig, 27 ref.

Descriptors: \*Water purification, Organic matter, Optical properties, Water, Water analysis, \*Elec-

Identifiers: \*Ultrapure water, \*Pyrodistillation, Ion selective electrodes. \*Catalytic

Recently, domestic and industrial water supplies have become contaminated by organic impurities that cannot be removed by ordinary or oxidative distillation because of steam volatility of the impurities of their derivatives. The results of using a pyrocatalytic distillation system for preparation of ultrapure water for electrochemical and surface

chemical work are described. Exacting electrochemical and optical criteria are defined for judging and characterizing the purity of water, with respect to organic impurities, especially with regard to their effects at Pt and Hg electrodes. (Little-Battelle)

DETERMINATION OF TRACE PHENOL IN AQUEOUS SOLUTION BY AQUEOUS LIQUID CHROMATOGRAPHY, Carnegie-Mellon Univ., Pittsburgh, Pa. Mellon Inst. of Science.

K. Bhatia.

Analytical Chemistry, Vol 45, No 8, p 1344-1347, July 1973. 3 fig, 1 tab, 8 ref.

Descriptors: \*Phenols, \*Pollutant identification, Waste water (Pollution), Water analysis, \*Aqueous solutions, Industrial wastes, Solvents, \*Chro-

ous solutions, Industrial wastes, Solvents, \*Chromatography,
Identifiers: \*Liquid chromatography, \*Chemical interference, Detection limits, Phenolic terphenyls, Bets-naphthol, Alpha-naphthol, Sensitivity, Aromatic hydrocarbons, Organic solvents, Benzene, Bromobenzene, Pyridine, Aniline, Bromophenols, Chlorinated hydrocarbons, Chlorphenols, Catchol, Resorcinol, Hydroquinone. Ouinone. Trihydroxybenzenes. one, Quinone, Trihydroxybenzenes, Aminophenols, Biphenyls, Phenylphenol, Indoles,

Liquid chromatographic methods capable of use both for identification of trace quantities of phenols in aqueous solution and for the quantitative analysis of mixtures whose components are known are described. An optical detector utilizing the 254-nm mercury resonance line was used. Phenol in the aqueous phase can be accurately determined down to 0.00001 M (less than mg/l). Further improvement in the sensitivity of the method for quantitative analysis of phenol can be achieved by using larger samples and a detector operating at about 270 nm. The presence of di- and trihydroxybenzenes, most other substituted ols, naphthols, and phenolic bi- and terphen-n the solutions does not interfere in the deteryls in the so mination of phenol. The application of aqueous liquid chromatography to the determination of phenols in industrial waste waters is demonstrated. The methods can be easily extended to the determination of individual substituted phenols down to at least 0.00001 M. (Little-Battelle) W73-14303

CORRELATION OF ENHANCEMENT OF ATOMIC ABSORPTION SENSITIVITY FOR SELECTED METAL IONS WITH PHYSICAL

SELECTED METAL IONS WITH PHYSICAL PROPERTIES OF ORCANIC SOLVENTS, Murray State Univ., Ky. Dept. of Chemistry. A. J. Lemonds, and B. E. McClellan. Analytical Chemistry, Vol 45, No 8, p 1455-1460, July 1973. 6 fig, 3 tab, 20 ref.

Descriptors: \*Heavy metals, Cadmium, Nickel, Cobalt, Zinc, Solvents, Aqueous solutions, \*Spectrophotometry, Alcohols.

Identifiers: \*Atomic absorption spec-

Identifiers: \*Atomic absorption spec-trophotometry, \*Organic solvents, Signal enhancement, Esters, Silver, Sensitivity, Ketones.

Various alcohols, ketones, esters, and other organic compounds, as solvents for Ag, Cd, Co, Ni, and Zn ions, were studied to determine the enhancement of atomic absorption values for each metal-solvent system and to correlate the enhance-ment values with the physical properties of the sol-vents. Optimum instrumental conditions were determined for each metal-solvent system employdetermined for each metal-solvent system employ-ing two different burner-aspirator systems. Ab-sorbance values for the metal-organic solvent systems were measured and compared with the ab-sorbance values for the aqueous system of the same concentration in order to calculate an enhancement value. Plots of enhancement vs. log viscosity and enhancement vs. log boiling point for

#### Group 5A-Identification of Pollutants

each ion resulted in lines with negative slopes. Various plots involving density and surface ten-sion showed little or no dependence of enhancement on either of the constants. However, a lin relationship existed between log (viscosity X boil-ing point) and enhancement. (Little-Battelle) W73-14304

ESTIMATING PRECISION FOR THE METHOD OF STANDARD ADDITIONS, Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 02K.

SELECTED METALS IN SEDIMENTS, WATER, AND BIOTA IN THE ILLINOIS RIVER, Bradley Univ., Peoria, Ill. Dept. of Biol For primary bibliographic entry see Field 05B.

REDUCTION AND EVALUATION OF BIOLOG-ICAL DATA, Environmental Protection Agency, Ada, Okla. Of-

fice of Technical Programs.
R. D. Harkins, and R. E. Austin. Journal Water Pollution Control Federation, Vol 45, No 7, p 1606-1611, July 1973. 1 fig. 2 tab, 11

Descriptors: \*Sampling, \*Mathematical studies, Water pollution, Equations, Biological communities, Computer programs, Bioindicators, Water quality, Statistical methods, \*Louisiana. Identifiers: \*Data interpretation, Artificial sub-

strates, Species diversity, Anacoco Bayou, \*Sabine River, Biological indexes, Rock baskets, Multiplate samplers Aquatic organisms were collected from the area

surrounding the confluence of Anacoco Bayou and the Sabine River, Louisiana, in an attempt to develop a single biological index useful in evaluating water quality. A secondary objective was to compare artificial substrate samplers: rock-filled baskets and multiplate samplers. Samplers were retrieved after 4 weeks, and the organisms har-vested by scrubbing, identified, and counted. An equation based on information theory was developed to process the data. Computer programs were written to do the calculations as well as the analysis of variance. It is concluded that the method can objectively reduce several biological indexes to a single meaningful value. Resulting sets of standardized distance values can be con pared subjectively or can be subjected to statistical evaluation and probability levels of differences assessed. There was no indication of differences between samplers or interaction between samplers and site. (Little-Battelle) W73-14310

PROTEINS IN WASTEWATER AND WASTE-

WATER SLUDGES, Indian Inst. of Science, Bangalore. Dept. of Biochemistry. M. K. C. Sridhar, and S. C. Pillai.

Journal Water Pollution Control Federation, Vol 45, No 7, p 1595-1600, July 1973. 1 fig, 2 tab, 32

Descriptors: Waste water (Pollution), "Activated sludge, Septic tanks, "Proteins, "Sewage bacteria, "Sewage sludge, "Protozoa, "Pollutant identification, Solubility, Nitrogen, Amino acids, Solvent extractions, Biomass, Water, Sodium chloride. extractions, pomanss, water, Solutim cinorde. Identifiers: Organic solvents, Inorganic solvents, Epistylis articulata, Albumins, Globulins, Glu-telins, Prolamins, Ciliates, Bacterial populations, Sodium hydroxide, Acetic acid, Ethanol.

The proteins found in raw wastewater, septic tank sludge, activated sludge, the mixed bacteria from activated sludge, the dominant protozoan Epistylis

articulata in activated sludge, and the bacteria associated with the protozoan were identified on the basis of their solubilities in several solvents. On an equal dry-weight basis, these materials contained about 11, 17, 43, 73, 60, and 78 percent total proteins, respectively. Qualitatively, there were striking similarities between raw wastewater and septic tank sludge, between activated sludge and the protozoan, and between the two bacterial preparations in the distribution of the different protein fractions (albumins, globulins, glutelins, and prolamins). These observations seem to be of considerable significance in the study of the microbiology of wastewater and sludges and their protein contents. (Holoman-Battelle)

FINAL REPORT ON DRIFT STATION BIOLO-GY: ZOOPLANKTON TAXONOMY AND SORT-ING PROGRAMS.

University of Southern California, Los Angeles. Dept. of Biological Sciences. For primary bibliographic entry see Field 02I. W73-14312

SOME ROTIFERS FROM CAMBODIA. Lund Univ. (Sweden). Limnological Inst. For primary bibliographic entry see Field 02I. W73-14313

THE TESTACEA IN THE AREA OF BUSCHEL-BACH STATION (BIEBER/SPESSART, GER-MANY), (DIE TESTACEEN IN DER UM-GEBUNG DER STATION BUSCHELBACH GEBUNG DER STATION BUSCHELBACK (SPESSART/BRD)), Salzburg Univ. (Austria). Lunz Biological Station.

For primary bibliographic entry see Field 021. W73-14314

WATER CHARACTERISTICS.

Maine Univ., Orono. Journal Water Pollution Control Federation, Vol 45, No 6, p 986-995, June 1973. 72 ref.

Descriptors: \*Water analysis, \*Water quality, \*Reviews, \*Bibliographies, Hydrogen ion concentration, Acidity, Alkalinity, Color, Odor, Turbidi-

tration, Acidity, Alkalinity, Color, Odor, Turbidi-ty, Suspended solids, Water temperature, Conduc-tivity, Ammonia, Oxidation-reduction potential, Radioactivity, Monitoring, Instrumentation, Fil-tration, Phytoplankton, Waste water (Pollution), Spectrophotometry, Automation. Identifiers: Sample preparation, Data interpreta-tion, Detection limits, Particulate matter, Dis-sociation constants, Polystyrene latex, Gas liquid chromatography, Turbidimeters, Odormeter, Ion selective electrodes, Membrane electrodes, Iodates, Chromates, Recorders, Photon activation Iodates, Chromates, Recorders, Photon activation analysis, Charged particle activation, Sr-90, Cs-137, Ce-144, Coprecipitation, Fe-59, Zr-95, Ru-106, Co-60, Zn-65, Y-90.

The 1972 literature on methods for determining water characteristics is reviewed. Methods are considered for pH, acidity, alkalinity, color, odor, residue, turbidity, suspended solids, temperature, conductivity, particulate matter, ammonia, redox, radioactivity, and concentration of phytoplankton. Models and mathematical relationships for interpreting data are also reviewed. (Little-Battelle) W73-14316

ORGANICS.

Illinois Inst. of Tech., Chicago. Dept. of Environ-mental Engineering. R. A. Minear, J. J. Benko, P. T. Lambert, J. R.

Marsh, and C. M. Palesh.

Journal Water Pollution Control Federation, Vol 45, No 6, p 995-1018, June 1973. 1 tab, 155 ref.

Descriptors: "Analytical techniques, "Organic compounds, "Pollutant identification, "Bibliographies, Detergents, "Oxygen demand, "Reviews, Water analysis, Surfactants, Toxicity, Oil, "Pesticides, Polychlorinated biphenyls, Organophosphorus pesticides, Carbamate pesticides, Vitamin B, Water quality, Biochemical oxygen demand, Benthos, Chemical oxygen demand, Automation, Monitoring, Feed lots, Runoff, Waste water (Pollution), Absorption, Biomass. Identifiers: Biological samples, Ion selective electrodes, Oxygen demand index, Organic carbon, Detection limits, Thermal analysis, Flame ionization detectors, Adenosine triphosphate, Carboxymethylcellulose, Anionic detergents, Nonionic detergents, Macroinvertebrates, Ostrea erdules, Crassostrea gigas, Characterization, Oil characterization, Fuel oil, Oil residues, Crude oil, Lasers, Radar, Oil dispersants, Grease, Gasoline.

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Literature from 1972 is reviewed with respect to analytical methods for oxygen demand, organ carbon, detergents, oil, grease, and or-ganochlorine, organophosphorus, and carbamate pesticides. Toxic effects of the pollutants are discussed. (Little-Battelle)

CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES, Michigan Univ., Ann Arbor. S. E. Herbes, and H. E. Allen.

Journal Water Pollution Control Federation, Vol 45, No 6, p 1018-1026, June 1973. 81 ref.

Descriptors: "Monitoring, Chemical analysis, \*Reviews, "Bibliographies, "Water quality, \*Sampling, "Water analysis, "Instrumentation, Automation, Industrial wastes, Dissolved oxygen, Conductivity, Suspended solids, Water temperature, Pollutant identification, Oxidation-reduction potential, Hydrogen ion concentration, Ammonia, organic compounds, Oil, Chlorides, Nitrates, Flow rates, Phenols, Chemical oxygen demand, Silica, Hardness (Water), Iron, Phosphates, Chlorine, Manganese, Nutrients, Gas chromatography, Pesticides, Nitrites, Detergents, Sedi-Data processing, Calibrations, teria, Respiration, Water pollution effects, Rivers, Photometry, Oil spills, Remote sensing, Absorption, Ultraviolet radiation, Infrared radiation, tion, Ultraviolet radiation, Infrared radiation, Heavy metals, Fluorescence, Fluorometry, Chlorophyll, Cadmium, Aluminum, Spectrophotometry, Separation techniques, Sodium, Deuterium, Mass spectrometry, Volumetric analysis, Alkalinity, Sulfates, Sulfides, Colorimetry, Silicates, Surfactants, Nitrogen, Radar, Flame photometry, Waste water (Pollution), Automatic control, On-site investigations.

control, On-site investigations.
Identifiers: Ion selective electrodes, Detection limits, Organic carbon, Autoanalyzer, Ozone, Hydrazine, Turbidimeters, Anionic detergents, Chronopotentiometry, Voltammetry, Aromatic hydrocarbons, Differential photometry, Differential polarization, Microwave, Multispectral sensing system, Lasers, Lignin sulfonate, Chlorophyll a, Atomic absorption spectrophotometry, Sensitivity, Vanadium, Chemical interference, Potentiometry, Cyanides, Kjeldahl nitrogen, Sample preservation.

ane 19/2 literature is reviewed with respect to capabilities for monitoring, automatically analyzing, and sampling water for water quality parameters and the presence of organic and inorganic polutants. A brief discussion is included of remote monitoring systems, automatic laboratory analysis, remote sensing, data handling, and sampling frequency. (Little-Battelle) The 1972 literature is reviewed with respect to

WATER QUALITY MONITORING ON THE MISSISSIPPI RIVER HAS ITS PITFALLS, Saint Louis Metropolitan Sewer District, Mo. For primary bibliographic entry see Field 05B.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants-Group 5A

SOME INSTRUMENTS AVAILABLE NOW FOR THE MEASUREMENT OF WASTEWATER PARAMETERS, lonics, loc., Watertown, Mass. Instrument Div.

D. L. Brown

In: Water-1972, AIChE Symposium Series No 129, Vol 69, p 585-588, 1973. 7 fig, 2 ref.

Descriptors: \*Instrumentation, \*Monitoring, \*Onsite data collections, \*Laboratory tests, Waste
water (Pollution), \*Water properties, \*Measurement, Water quality, Chemical analysis, Automatic control, Pollutant identification, Operations,
Physical properties, Caygen demand, Volumetric
analysis, Water analysis, Carbon dioxide, Water
pollution, Water temperature, Dissolved oxygen,
Hydrogen ion concentration, Conductivity,
Hydrogen, Nitrogen, Sulfur, Carbon, Oxygen.
Identifiers: On-line measurement, Organic carbon,
Dissolved oxygen analyzers. Total carbon
plessolved oxygen analyzers. Total Descriptors: \*Instrumentation, \*Monitoring, \*On-Identitiers: On-line measurement, Organic carbon, Dissolved oxygen analyzers, Total carbon analyzer, Organic carbon analyzer, Total organic carbon, Total oxygen demand, Total oxygen demand analyzer, Reliability, Reproducibility, Cyanides, Potentiometric titration.

A brief summary and a student review and critique are given of the instruments presently available for measuring wastewater parameters. These instru-ments include dissolved oxygen analyzer, multiparameter water quality monitor, total carbon analyzer, organic carbon analyzer, total oxygen demand analyzer, an on-line, automatic titrator, and an instrument for measuring carbon dioxide demand. (Holoman-Battelle) W73-14321

MEASUREMENT OF ORGANIC WASTE-

WATER PARAMETERS, Battelle Memorial Inst., Columbus, Ohio. Organic Chemical Div. M. B. Neher

In: Water-1972, AIChE Symposium Series No. 129, Vol 69, p 600-602. 1973.

Descriptors: \*Monitoring, \*Waste water (Pollution), \*Organic wastes, \*Measurement, \*Pollutant identification, \*Instrumentation, Properties, Pollutants, Biochemical oxygen demand, Chemical oxygen demand, Automatic control, Digital computers, Mass spectrometry, Sampling, Methodolo-

Identifiers: Process streams, GC-Mass spectrometry, Infrared spectrophotometry, Gas liquid chromatography, Total organic carbon, Total oxygen demand.

Techniques are discussed for the measurement of organic wastewater parameters including BOD, total carbon, total organic carbon, total organic carbon, total oxygen demand, and COD. The analytical instruments are (1) continuous monitoring and (2) intermittent sampling instruments which include automated GLC, a mass spectrometer, digital computer pro-grammed gas chromatograph-mass spectrometers, nd infrared spectrometry. Only a limited numbe of organic parameters, however, can be measured on a continuous basis. Also only a few instruments are available for monitoring the organic content of water, and these give measurements only of total organic carbon content. The drawback for control purposes would seem to be an inability to specify organic constitutents and demonstrate a toxicity effect of a wastewater. (Holoman-Battelle)

PRACTICAL EXPERIENCE OF THE WATER RESOURCES DIVISION IN THE USE OF MUL-TIPARAMETER ELECTRONIC RECORDERS AND AUTOMATED TECHNIQUES FOR MONI-TORING WATER QUALITY IN STREAMS, Geological Survey, Washington, D.C. Water Resources Div.

R. J. Pickering. In: Water-1972, AICHE Symposium Series No. 129, Vol 69, p 603-606. 1973. 3 ref.

Descriptors: "Monitoring, "Water quality, "Automation, "Electronic equipment, Water analysis, Data transmission, Methodology, Data collections, Water properties, Water temperature, Specific conductivity, Dissolved oxygen, Hydrogen ion concentration, Turbidity, Amonia, Nitrates, Nitrites, Phosphates, Streams, Flow rates, Telemetry, Maintenance, Streamflow, Pumps. Pumps. Identifiers: \*Recorders.

The stream monitoring practices of the U. S. Geological Survey are reported along with the difficulties experienced in using field monitoring equipment. The parameters measured are: specific conductance, temperature, dissolved oxygen, pH, turbidity, ammonia, nitrate, nitrite, and hydrolyza-ble phosphates. The first five parameters are electronically monitored; the last four are monitored by wet chemistry techniques. A bubbler method is used for stream flow measurements. The wet chemistry analyzers require the most attention. Telemetering of data involves the collection of measurements taken at several sampling sites. The recorders are digital to make telemetering simpler. Perhaps in the future such data can be collected and transmitted by satellite to a centrally located ground acquisitioning site for computer manage-ment. (Little-Battelle) W73-14323

FACTORS INFLUENCING THE FREQUENCY

OF SAMPLING, PEDCo-Environmental Specialists, Inc., Cincinnati, Ohio. G. Jutze.

In: Water-1972, AIChE Symposium Series No. 129, Vol 69, p 610-611. 1973.

Descriptors: \*Sampling, \*Waste water (Pollution), Treatment facilities, \*Frequency, \*Monitoring, Sewage effluents, Waste assimilative capacity, Waste water treatment, Flow, Properties, Methodology, Toxicity.

Sampling frequency is an indispensable considera-tion in determining how wastewater parameters are to be measured. The factors that must be considered in determining monitoring frequency are: (1) variability of incoming waste, its flow and characteristics; (2) characteristics of the process; and (3) the effect of process upset on receiving streams. (Holoman-Battelle) W73-14324

REMOTE ANALYSIS OF AIRBORNE PARTI-CLES BY POLARIMETRY, Arizona Univ., Tucson. Lunar and Planetary Lab. For primary bibliographic entry see Field 07B. W73-14341

THE ANALYSIS OF TRITIUM OXIDE FROM SELECTED AREAS OF THE CONNECTICUT

RIVER, Connecticut Univ., Storrs. Inst. of Water D. M. Skauen.

D. M. Skauen.

Available from the National Technical Information Service as PB-223 499, \$2.75 in paper copy, \$1.45 in microfiche. Completion Report, 1973. 8 p, 9 tab, 1 fig, 1 ref. OWRR A-044-CONN (1). 14-31-0001-3507.

Descriptors: Tritium, \*Spectroscopy, Environ-ment, Water sampling, \*Connecticut River, Analytical techniques, \*Pollutant identification. Identifiers: \*Tritium oxide, \*Liquid scintillation spectroscopy.

Various techniques for the estimation of low-level tritium oxide were considered. A method based on liquid scintillation spectroscopy was selected as the most useful for routine analysis. All instrument and sample preparation parameters were studied experimentally for their applicability to the type of

samples to be analyzed. The analytical technique thus developed was used to determine the tritium oxide in a variety of water samples including winter and spring samples from the Connecticut River in 1973. W73-14362

REMOTE SENSING OF WATER QUALITY: A

STATE OF THE ART REPORT, Florida Univ., Gainesville. Dept. of Environmen-tal Engineering Sciences. W. J. Mitsch.

w. J. Mitsch. Available from the National Technical Informa-tion Service as PB-223 503, \$2.75 in paper copy, \$1.45 in microfiche. Florida Water Resources Research Center Publication No. 21, 1973, 14 p, 9 fig. 43 ref. OWRR A-999-FLA (5). 14-31-0001-3809.

Descriptors: "Remote sensing, Photogrammetry, "Water quality, Reviews, Natural resources, "Satellites (Artificial), "Pollutant identification. Identifiers: Infrared scanning, Multispectral scanning, "Earth resources satellite."

Remote sensing, or the carrying out of aerial or space surveys of the earth's surface, is finding several applications in the fields of water quality and water resource management. It offers a means of obtaining large amounts of data, but its value is in the expansion of data in the spatial, temporal in the expansion of data in the spatial, temporal and spectral modes. The most valuable techniques presently are photography, infrared scanning and multispectral scanning. Aircraft applications include the measuring of the distribution of various waste discharges into water bodies and the study of aquatic plant growth and benthic communities. The ERTS (Earth Resources Technology Satellite) program of the U. S. Department of the Interior is investigating satellite applications of monitoring the earth's resources. The water resource applica-tions are less obvious than those of the aircraft and concern environmental indicators on a much larger scale. However, the satellite offers the enhancement of data in the temporal mode with periodic remote sensing of most of the earth's surface. (Morgan-Florida) W73-14363

STRIP-MINED WATERSHED HYDROLOGIC DATA ACQUISITION STUDY, Tennessee Univ., Knoxville. Dept. of Civil En-

gineering.
For primary bibliographic entry see Field 07B. W73-14368

LOW LEVEL BOD DETERMINATIONS BY THE ELECTROLYSIS METHOD.

Iowa State Univ., Ames. I. A. Merideth

Master's Thesis, 1969, 155 p. 18 fig. 12 tab, 38 ref.

Descriptors: \*Biochemical oxygen demand, \*Elec-Descriptors: Biochemical oxygen demand, 'Electrolysis, 'Laboratory tests, Instrumentation, Nitrification, Nutrients, Time lag, Statistical methods, Water analysis, Water quality control, 'Waste water treatment, Analytical techniques. Identifiers: 'Dilution method, 'Seed concentration, Standard deviations.

Low strength synthetic substrates and actual Low strength synthetic substrates and actual stream samples were analyzed using the Standard Method's BOD test and by electrolysis, to deter-mine the adaptability of the electrolysis technique to low level BOD waters and compare the results obtained to those obtained with the standard test. Conclusions drawn from inital testing included: (1) seed concentration has a definite effect on both K and L values since it effects lag times; (2) nitrification should either be inhibited or accounted for in BOD determinations; (3) addition of nutrients to low BOD stream water produced little or no effect on the BOD determination; (4) CO2 adsorption during electrolysis did not inhibit oxygen demand

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exertion; (5) deviations of from 3.5 to 6% of the average 5day BOD values were obtained by electrolysis. In comparing the two methods it was found that: (1) both methods require the same time for one reading, but if daily readings are to be taken the electrolysis method is much more efficient; (2) the electrolysis method was demonstrated to be at least equal, if not superior, to the dilution method for accuracy of results; and (3) the lower the BOD value of the sample, the more difficult it will be to obtain close agreement of values for either method. (Lowry-Texas) W73-14391

THE APPLICATION OF GAS CHROMATOG-RAPHY OF VOLATILE METAL CHELATES TO WATER ANALYSIS, Illinois Inst. of Tech., Chicago. Dept. of Environ-

mental Engineering.
For primary bibliographic entry see Field 02K.

W73-14393

DIRECT VAPORIZATION AND QUANTIFICA-TION OF ARSENIC FROM SOILS AND WATER,
Texas A and M Univ., College Station. Dept. of

Agricultural Analytical Services; and Texas M Univ., College Station. Dept. of Soil and Crop

J. R. Melton, W. L. Hoover, J. L. Ayers, and P. A.

Soil Science Society of America Proceedings, Vol 37, No 4, p 558-561, July-August 1973. 3 fig, 3 tab,

Descriptors: \*Arsenic compounds, \*Chemical analysis, "Spectrophotometry, Flame photometry, Soil chemistry, Water chemistry, Water analysis."

A procedure is described for the determination of arsenic in soils at the parts per million level and water at the parts per billion level. Determinations are made by direct introduction of arsine gas into the flame of an atomic absorption spec-trophotometer. An easily constructed apparatus is described for introducing arsine into the flame. Soils from various states, as well as water samples from Texas waterways, are studied for arsenic content. Recoveries of arsenic added to soils and water samples ranged from 93.0% to 106.0%. (Knapp-USGS) W73-14416

SIMPLE ARRANGEMENT FOR THE DETEC-TION OF SULPHUR IN GAS-CHROMAT-OGRAPHIC ELUATES, (EINFACHE ANORD-NUNG ZUM NACHIWEIS VON SCHWEFEL IN GAS-CHROMATOGRAPHISCHEN ELUATEN), Universitaet des Saarlandes, Saarbruechen (West Germany). Institut fuer Analytische Chemie und

E. Blasius, and H. Lohde. Zeitschrift fur Analytische Chemie, Vol 264, No 4, p 286-289, May 7, 1973. 3 fig, 1 tab, 11 ref.

Descriptors: \*Gas chromatography, \*Sulfur, \*Pollutant identification, Laboratory equipment. Identifiers: \*Detection limits, Sample preparation.

The described apparatus for the detection of sulphur in gas-chromatographic eluates is based on the hydrogenation of compounds of sulphur to H2S and its detection with a thin-layer plate containing Pb (CH3COO)2. The Pbs zones obtained can be evaluated optically, too, by measurement of the degree of remission. The limit of detection is 5 ng of sulphur (as CS2). Sixteen sulphur compounds can be detected in the pyrograms of a strong acid cation-exchanger. (Little-Battelle)

THE SPECTROPHOTOMETRIC DETERMINA-TION OF PALLADIUM WITH 4- (6-CHLORO--2-PYRIDYL)AZO)-1,3-DIAMINOBENZENE, Government Industrial Research Inst., Nagoya

(Japan). S. Shibata, Y. Ishiguro, and R. Nakashima. Analytica Chimica Acta, Vol 64, No 2, p 305-309, April 1973. 4 fig, 2 tab, 5 ref.

Descriptors: \*Water analysis, \*Spectrophotometry, \*Aqueous solutions, Heavy metals, Calibrations, Pollutant identification, Ab-Identifiers: \*Palladium, Sample preparation, Sensitivity, Chemical interference, Calibration

(5-chloro-2-pyridyl)azo)-1,3diaminobenzene (5-Cl-PADAB) as the reagent, diaminotenzene (3-C1-F1AB) as in reagent, microgram amounts of palladium can be determined by spectrophotometry. The recommended procedure is as follows. To a 25-ml volumetric flask, transfer a suitable aliquot of acidic sample solution containing up to 25 micrograms of palladium, and add 0.5 ml of ethanolic 0.08 percent reagent solution. Then add 5 ml of (l plus 1) hydrochloric acid solution, dilute to volume and mix well. Measure the absorbance of the palladium lex produced at 572 nm against a reagent blank. Obtain the concentration of palladium from a standard calibration curve obtained under identical conditions. The calibration curve proved to be linear up to 1 ppm Pd. Interference tests showed that Al, Be, Bi, Cd, rare earths, Mg, Ca, Mn, Pb, Th, Ti, U, Zn, Zr in 5 mg amounts, V, W, Ni, Cr, in 1-2 mg amounts, and 0.5 mg of Co did not interfere. Five-fold amounts of iron (III) and two-fold amounts of copper did not interfere. Interference was caused only by chromium (VI). Common anions such as chloride, nitrate, acetate, sulfate and perchlorate did not interfere. Strong oxidizing agents interfered. (Little-Battelle)

ATOMIC ABSORPTION AND FLUORESCENCE SPECTROMETRY WITH A CARBON FILA-MENT ATOM RESERVOIR. PART XIII. THE DETERMINATION OF CHROMIUM WITH A FULLY ENCLOSED ATOM RESERVOIR, Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry. K. W. Jackson, T. S. West, and L. Balchin. Analytica Chimica Acta, Vol 64, No 3, p 363-369,

May 1973. 3 fig, 1 tab, 11 ref. Descriptors: \*Chromium, Heavy metals, Laboratory equipment, Aqueous solutions, \*Water analysis, \*Spectrophotometry.

Identifiers: \*Chemical interference, \*Atomic absorption spectrophotometry, Sensitivity, Detec-

The detection and measurement of chromium by atomic absorption spectrometry with a carbon fila-ment atom reservoir is described. At a wavelength of 357.9 nm, a sensitivity (1 percent absorption) of 9.2 X 10 to the minus 12 power g was obtained. The detection limit was 10 to the minus 11 power g; in terms of concentration this is similar to that normally detectable in a flame. Interferences resulting from the presence of various levels of Sr. Fe (III), Co (II), Cu (II), Ca, Ba, Al, Sn (II), Sb, RB, Ti (IV), Pb, Mn (III, Zn, Hg (II), and V (V) were determined. (Little-Battelle)

THE FLUORIMETRIC DETERMINATION OF MERCURY,
Dalhousie Univ., Halifax (Nova Scotia). Trace
Analysis Research Centre.
J. Holzbecher, and D. E. Ryan.
Analytica Chimica Acta, Vol 64, No 3, p 333-336,
May 1973. 2 fig. 3 ref.

•Water \*Mercury, analysis. Descriptors:

Descriptors: "water analysis, "Mercury, "Fluorometry, Aqueous solutions, Heavy metals, Fluorescence, Calibrations. Identifiers: "Sample preparation, Precision, Chemical interference, Detection limits, Or-ganomercury compounds, Calibration curves.

The use of thiamine for the fluorometric determination of mercury is described. Stock solutions for analysis were prepared from mercury (II) chloride. The analytical procedure involved adding several milliliters of approximately neutral unknown solution (10-500 ng Hg per mi) and thiamine reagent to a borate buffer and making up to volume with twice-distilled water. It is important that the resulting solution contain less than 2.22 that the resulting solution contain less than 0.02 M foreign salts. The fluorescence intensity is meaforeign salts. The fluorescence intensity is measured at 440 nm after 1 hr or more; the excitation wavelength is 375 mm. Mercury must be present in the divalent state since Hg (I) gives a fluorescent intensity about half that of Hg (III). Organomercury compounds can only be analyzed after destruction of organic matter by acid digestion and conversion to inorganic Hg (II). Mercury (III) was successfully determined in the presence of a 10,000-fold (molar) amount of nickel (II), cobalt (II) or zinc (II); a 1000-fold amount of copper (II), cadmium (III), manganese (III) or a luminum (III); or a 100-fold amount of iron (III) or inor (III). Similarly. um (II), manganese (II) or auminum (III), or a 100-fold amount of iron (III) or iron (III). Similarly, 100,000-fold amounts of the sodium or potassium salts of acetate, chloride, citrate, sulfate or tar-trate did not interfere. A 10,000-fold amount of fluoride, nitrate, perchlorate or phosphate, and a 1000-fold amount of bromide and thiocyanate could be tolerated; the fluorescence was quenched by equivalent amounts of cyanide, iodide, sul-phide or EDTA. Tap water samples spiked with mercury (II) chloride were anlyzed by this procedure with a relative error of determination of less than 5 percent. (Little-Battelle)

AND PROPERTIES **ISOLATION** RIBONUCLEASE-DEFICIENT MUTANT OF SALMONELLA TYPHIMURIUM, California Univ., Davis. Dept. of Bacteriology. C. T. Wehr.

Journal of Bacteriology, Vol 114, No 1, p 96-102, April 1973. 5 tab, 33 ref.

Descriptors: \*Enzymes, \*Separation techniques, \*Growth rates, Cultures, Salmonella, \*Isolation. Identifiers: \*Salmonella typhimurium, Mutants.

A mutant of Salmonella typhimurium has been iso-lated that has less than 5 percent of the ribonuclease activity of the parent strain. Mutant screening and enzyme assays were done in the presence of ethylenediaminetetraacetic acid, a substance that activates ribonuclease I and inhibits other known microbial nucleases. The enzyme may perform a scavenge function in the utilization of exogenous ribonucleic acid. Loss of this enzyme seems to have no detrimental effects on the growth of Salmonella. (Little-Battelle) W73-14443

CALCULATION OF TURBIDIMETRIC MICROBIOLOGICAL VITAMIN ASSAY RESULTS, USING AN APL/360 COMPUTER PROGRAM, Food and Drug Administration, Washington, D.C.

G. V. Bround, E. W. Haskins, and G. A. Hudson, Journal of the Association of Official Analytical Chemists, Vol 56, No 3, p 754-757, May 3, 1973. 5 fig, 1 tab, 3 ref. Div. of Nutrition

Descriptors: \*Computer programs, \*Cultures, \*Bioassay, \*Vitamins, Turbidity, Equations, Microbiology, Data processing.

An APL-360 computer program is described for the calculation of results from microbiological vitamin assays. The results are compared to

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#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Identification of Pollutants-Group 5A

manual calculations specified in official AOAC methods. This comparison shows the validity of the computer program for these calculations. (Little-Battelle) W73-14448

ISOTACHOPHORESIS ON PAPER. PART II. THE SEPARATION OF AG (I), TL (I), HG2 (2

PLUS) AND PB (II), Consiglio Nazionale delle Ricerche, Rome (Italy). Laboratorio di Cromatografia.

Journal of Chromatography, Vol 79, p 380-382, May 16, 1973. 3 fig, 2 ref.

Descriptors: \*Separation techniques, \*Lead, \*Mercury, Heavy metals, Analytical techniques. Identifiers: \*Silver, \*Thallium, \*Isotachophoresis.

A Whatman No. I paper strip, sprayed with potassium chromate, was sandwiched between two glass plates and potential of 400 V applied for isotachophoretic separation of silver, mercurous mercury, lead (II), and thallium (I). Nitric acid was used as the leading electrolyte, and lithium nitrate used as the leading electrolyte, and ithnum nitrate as the terminating electrolyte. This simple unbuffered system permits the concentration and separation of both Ag (I) and I (I) and a complete separation of all four members of the silver group. (Little-Battelle) W73-14449

NITRITE REDUCTASE-DEFICIENT MUTANTS OF ESCHERICHIA COLI K12, Birminham Univ. (England). Dept. of Biochemis-

J.A. Cole, and F. B. Ward. Journal of General Microbiology, Vol 76, No 1, p 21-29, May 1973. 2 fig, 3 tab, 20 ref.

Descriptors: \*E. Coli, \*Separation techniques, \*Reduction (Chemical), Cultures, \*Nitrates, Nitrates, Enzymes, \*Isolation. Identifiers: Mutants, Nitrate reductase. \*Nitrites,

Mutants of Escherichia coli K12 have been iso-lated which reduce nitrite 3 to 30 percent as rapidly as the wild-type. Activities of reduced nicotina-mide adenine dinucleotide (NADH)-nitrite oxidoreductase were lower in cell-free extracts of these mutants than in the wild-type. The mutants grew on minimal agar, and their sulphite reductase activity was the same as in the wild-type. Double mutants deficient in both nitrite and sulfite reductases were constructed, as well as recominants which had regained one or both activities. The inability to reduce sulfite was due to a genetic altera-tion. (Little-Battelle) W73-14450

LAB AUTOMATION AT LOW COST, Digital Equipment Corp., Maynard, Mass. Lab. Data Products Group. For primary bibliographic entry see Field 07C. W73-14451

NEW METHOD FOR EVALUATION OF DIS-SOLVED OXYGEN PROBE RESPONSE FOR K SUB L A DETERMINATION, California Univ., Berkeley. Lawrence Berkeley

W. C. Wernau, and C. R. Wilke. Biotechnology and Bioengineering, Vol 15, No 3, p 571-578, May 1973. 3 fig, 15 ref.

Descriptors: Evaluation, \*Methodology, Labora-tory equipment, Automation, Equations, Perm-selective membranes, Dissolved oxygen, Re-sistance, Instrumentation.

Jeantifice: "Mass transfer coefficients, "Volu-metric liquid phase, "Dissolved oxygen probes, "Slope method, Response time, Slope (Mathe-matics), Accuracy.

Previously adopted methods for the measurement of the volumetric liquid phase mass transfer coefficient, K sub L a, in various liquid systems using dissolved oxygen probes have been problematic. The problems ranged from inability to define time in reference to step changes to the necessity of having vesy thin, highly permeable membranes in order to get accurate results. In order to alleviate such problems, a new method (the slope method) for finding K sub L a based on the transient response of dissolved oxygen probes was devised. Since the origin of time (time of the step change) is so poorly defined in actual experimental situaso poorly defined in actual experimental situa-tions, measurement of the slope of the response curve (d (Et/Eo)/dt) would appear to be depen upon the accurate estimation of the time of the step change. This problem is alleviated by taking step change. Into problem is alteviated by taking the slope at its maximum value. This procedure is illustrated diagramatically. This method is independent of the time of the step change and is applicable for slow probes at K sub L a values from approximately 20/hr to values in excess of 500/hr. The method is least accurate at high K sub L a values, where the sensitivity of the slope to beta is considerably reduced. It is recommended that the considerably reduced. It is recommended that the method of Linek be used at K sub L a values below 20/hr and that faster probes than that used in this study be employed for K sub L a values above 500/hr. (Holoman-Battelle) W73-14452

A PHOTON COUNTING DEVICE FOR THE MEASUREMENT OF NANOSECOND AND MICROSECOND KINETICS OF LIGHT EMIS-SION FROM BIOLOGICAL SYSTEMS, MSU-AEC Plant Research Lab., East Lansing,

Mich. H. C. Beall, and A. Haug. Analytical Biochemistry, Vol 53, No 1, p 98-107, May 1973. 2 fig. 18 ref.

Descriptors: \*Photosynthesis, \*Instrumentation, \*Biochemistry, Scenedesmus, Laboratory equipment, Electronic equipment, Bioassay, Biolu-

minescence. Identifiers: \*Scenedesmus obliquus, \*Photon counting, \*Light emission, Lasers, Photomultipliers, Analog to digital converters.

Instrumentation and operation are described of a instrumentation and operation are described of a photon counting system which was constructed to measure the delayed light emission from the alga Scenedesmus obliquus. The study of the kinetics of the delayed light emission, especially the fast kinetics of the nanosecond and microsecond re-gions, should produce evidence concerning the mechanism involved in the early photochemical and biochemical steps of photosynthesis. The functioning of the system was illustrated by a plot which compared data of the recorded delayed light emission with data of the system noise over the first 20-microsecond interval after extinction of a madulated between The willing of photos now. modulated laser beam. The utility of photon counting as a satisfactory method of measuring biologiing as a satisfactory method of measuring biologi-cal light emission, especially a very rapid process such as the delayed light emission from photosynthetic organisms is illustrated. (Little-Battelle) W73-14453

DETERMINATION OF ALUMINIUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY AFTER CHELATION WITH OXINE AND EXTRACTION WITH METHYL ISOBUTYL KETONE, Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils. B. H. Smith.

Laboratory Practice, Vol 22, No 2, p 100-102, February 1973. 5 fig., 7 ref.

Descriptors: \*Aqueous solutions, \*Aluminum, \*Separation techniques, \*Chelation, Water analy-sis, Iron, Fluorides, Phosphates, \*Spec-trophotometry.

Identifiers: \*Atomic absorption spec-trophotometry, Sample preparation, Chemical in-terference, Sensitivity, Precision, Detection limits, Oxalates, Citrates, Pyrophosphates, Orthophosphates.

Solutions of aluminum were prepared from A12 (SO4)3 (NH4)2 SO4.12H20 made up in HC1. Aliquots containing 0 to 100 micrograms of A1 were prepared by dilution with distilled water to give concentrations of 2 to 20 ppm A1. The samples were prepared for AA analysis by chelation of the A1 with oxine and extraction with methyl isobutyl ketone. The chelation step had the effect of concentrations the A1, thereby extending the of concentrating the A1, thereby extending the range of usefulness of the method, and eliminating a number of interferences. A N20/C2H2 flame was used in the AA analysis with absorption measured at 30927 angstroms. The sensitivity of the method was approximately 0.3 ppm Al per 1 percent absorption with a detection limit of approximately 0.2 ppm. Precision ranged from 3-20 percent depending on concentration of Al. Interferences and methods for eliminating them were studied by ad-ding Fe (III), oxalate, fluoride, citrate, pyrophosphate, and orthophosphate. (Little-Bat-telle) W73-14454

ISOLATION OF SALMONELLAE FROM PORK CARCASSES,

Georgia Univ., Athens. Coll. of Veterinary Medicine.

J. A. Carpenter, J. G. Elliot, and A. E. Reynolds. Applied Microbiology, Vol 25, No 5, p 731-734, May 1973. 3 tab, 26 ref.

Descriptors: \*Pollutant identification, \*Hogs, \*Isolation, Enteric bacteria, Aerobic bacteria, Livestock, Mammals, Pollutants, Pathogenic bac-teria, \*Salmonella.

Identifiers: Salmonella derby, Salmonella anatum, Salmonella typhimurium, Salmonella indiana, Culturing techniques.

Four hundred and twenty pork carcasses from four abattoirs were examined for the presence of salmonellae by use of swabbing-enrichment techniques and contact plate methods. Carcasses from only one abattoir were found to be con-taminated by swabbing-enrichment (23.3 percent) and contact plate (17.9 percent) methods. The area of the skin side of the ham, near the anal opening, was determined to be the area to examine for isolating salmonellae from pork carcasses with the greatest frequency. The most frequently isolated species of salmonellae in this study were Salmonella derby, S. anatum, S. typhimurium, and S. indiana. (Holoman-Battelle) W73-14455

ABOLITION OF SWARMING OF PROTEUS BY P-NITROPHENYL GLYCERIN: APPLICATION TO BLOOD AGAR MEDIA, Iowa State Univ., Ames. Dept. of Bacteriology.

F. D. Williams.
Applied Microbiology, Vol 25, No 5, p 751-754, May 1973. 2 tab, 5 ref.

Descriptors: \*Inhibition, Inhibitors, Aerobic bacteria, Pathogenic bacteria, Cultures.
Identifiers: \*Swarming, \*Proteus, Culture media, Blood agar, p-Nitrophenyl glycerin, Plate counts, Comparative tests, Sodium azide, B-Phenylethanol, Bacterial physiology, Vibrio chloerae, Pseudomonas aeruginosa, Listeria monoculture. Pseudomonas aeruginosa, Listeria mono-cytogenes, Klebsiella pneumoniae, Streptococcus pneumoniae, Streptococcus pyogenes, Staphylococcus aureus, Biochemical tests.

Comparative plate counts were made of Staphylococcus aureus and Streptococcus pyogenes growing on blood agar supplemented with individual chemicals to abolish the swarming of Proteus. B-phenylethanol, sodium azide, and p-

#### Group 5A-Identification of Pollutants

nitrophenyl glycerin (PNPG) were used as antinitrophenyl glycerin (PNPG) were used as anti-swarm agents. Each anti-swarm agent effectively abolished swarming for 24 h, but azide failed to control swarming for longer periods of incubation. In addition, azide displayed growth inhibition towards the staphylococci and streptococci result-ing in no hemolysis and reduced viable cell num-bers with the streptococci. Phenylethanol showed reduced viable cell numbers with the streptococci and unreliable hemolytic reactions. At 0.1 to 0.3 mM\_PNPG proyed to be a superior anti-swarm and unrelated nemotylet features. At 10 (3) mm, PNPG proved to be a superior anti-swarm agent in that it showed no growth inhibition and allowed normal hemolysis, but abolished swarming for extended periods of time. When laboratory strains of Streptococcus pneumoniae, Klebsiella pneumoniae, Pseudomonas aeruginosa, Listeria pneumoniae, Pseudomonas aeruginosa, Listeria monocytogenes, and Vibrio cholerae were screened on a blood agar medium containing 0.1 mM PNPG they displayed similar growth and hemolytic characteristics to the identical medium without PNPG. (Holoman-Battelle) W73-14456

A PRELIMINARY BASELINE STUDY OF ROBERTS AND STURGEON BANKS, British Columbia Univ., Vancouver. Westwater Research Centre. C. A. Bawden, W. A. Heath, and A. B. Norton

Technical Report No. 1, March 1973. 54 p, 9 tab, 6

Descriptors: Environmental effects, \*Mud flats, Animal populations, Wildlife, Pesticide residues, Anima populations, without, resulted resulter, Sediments, Sampling, Deltas, Tidal marshes, Heavy metals, \*Canada, \*Baseline studies, \*Aquatic population, \*Data collections. Identifiers: \*Lower Fraser River (B. C.).

An extensive program covers biological, physical, and socio-economic aspects of the Lower Fraser River in British Columbia. Roberts and Sturgeon Banks are tidal flats in the Lower Fraser River delta. The purpose of the study was to determine the nature of the animal community of the Banks as of 1972. This included testing the larger animals for heavy metal and pesticide residues. Thirty-nine stations were sampled and 120 animals were tested. The data collected are presented on the type of species found, their relation to the grain size of sediment that they were found in, and their heavy metal and pesticide content. The study is intended to serve as a baseline for future studies of changes that may take place due to urban development and lower levels of water quality. It was found that the mudflats and estuarine area are not showing any signs of eutrophication. (Elfers-North Carolina)

A PRELIMINARY WATER QUALITY SURVEY OF THE LOWER FRASER RIVER SYSTEM, British Columbia Univ., Vancouver. Westwater Research Centre.

A. H. Benedict, K. J. Hall, and F. A. Koch Technical Report No. 2. April 1973. 50 p, 2 fig, 9 tab, I append.

Descriptors: \*Water quality, \*Water analysis, \*Data collections, Sampling, Sediments, Streamflow, \*Canada. Identifiers: \*Lower Fraser River (B.C.).

The Lower Fraser River and tributaries comprising a drainage basin area of 78,300 square miles, covers most of the Interior Plateau of British Columbia. Spring floods from melting snows create the basin's runoff. The flat gradient of the river in the valley below the Coast Mountains results in water levels and discharge rates being affected by tides as far up as Chillwark some 60 miles from the river mouth. The Lower Fraser is regarded at present as a clean stream but rapid development of the Province could seriously degrade its water quality. The report has three basic objectives: (1) to assemble and collate all available data on water quality in the river system from past studies; (2) to provide a broad overview e existing water quality in the entire system; and (3) to begin to use these data to identify the best approach for developing a means to predict future water quality levels. Several tables of data collected include a summary of data prior to 1972, and various data collected in the summer of 1972 oth the Lower Fraser and several tributaries Two key findings were that water quality in the tributaries is poorer than in the main stem and that there is no significant difference in quality between earlier data and the 1972 data. (Elfers-North Carolina) W73-14487

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION MASS SPECTROMETRY: SU-FONATES, SULFATES AND THIOSULFATES, Pennsylvania State Univ., University Park. Dept.

of Entomology.
R.O. Mumma, and F. J. Vastola.
Organic Mass Spectrometry, Vol 6, p 1373-1376, 1972. 1 tab, 7 ref.

Descriptors: \*Chemical analysis, \*Sulfates, \*Sulfonates. \*Mass spectrometry, Analytical fonates, \*Mass spectrometry, Analytical techniques, Organic compounds, Water pollution sources, Pollutant identification, Sewage efsources, Pollutant ident fluents, Detergents. Identifiers: \*Organic salts.

Sodium and potassium salts of organic sulfonates (1-decyl, 1-dodecyl and 1-hexadecyl), sulfates (1-hexyl, 1-decyl and 1-octadecyl) and thiosulfates (1-octyl, 1-dodecyl, 1-tetradecyl, 1-hexadecyl, benzyl and beta-phenylethyl) were ionized by laser tion and the positive ions were analyzed by time-of-flight mass spectrometry. The laser ioniza-tion mass spectra of the sodium salts of three alkyl sulfonates (1-decyl, 1-dodecyl and 1-hexadecyl) are tabulated. These salts, ranging in molecular weight from 244 to 328, produced simple intense spectra as did the 1-hexyl-sulfonates. The molecuspectra as did the 1-nexy1-suttonates, in a more-lar species plus a cation (M+Na) is always the most intense ion in the spectra. Other organic ions are observed because of the dimers plus a cation. Inorganic ions (Na2SO3)+, (Na3SO3)+ and (Na3SO4)+) of low relative intensity are produced in approximately equal abundance. The spectra of sodium sulfates (1-hexyl and 1-decyl) and potassium 1-octadecyl sulfate are also presented. These spectra are more complex than the spectra of the sulfonates. A number of the sodium thiosulfate salts possessed ions containing potassium. The sodium salts were not cleanly prepared by ion exchange chromatography and possesed small amounts of potassium ions. Potassium is more easily ionized than sodium and therefore small amounts of potassium ions are easily observed in sodium salts. (Woodard-USGS) W73-14546

RADIOCHEMICAL STUDIES ON EFFECT OF BATH: I. DETERMINATION OF MERCURY IN BATH: I. DETERMINATION OF MERCURY IN SPRING MUD BY NEUTRON ACTIVATION ANALYSIS (IN JAPANESE), Kyushu Univ., Beppu (Japan). Inst. of Bal-neotherapeutical Research I. H. Kawamura, and H. Kawakami.

J Hyg Chem, Vol 17, No 4, p 284-286, 1971, En-

glish summary. Identifiers: Bath, Excretion, "Japan (Beppu spa), "Mercury, Mud, "Neutron activation analysis, Radiochemical analysis, Springs, Toxicosis.

radiochemical analysis microamounts of mercury in hot spring water in 45 places in Beppu spa, mercury content in dried sludge and solution was determined by radiochemical analysis with Kon-ya S sludge. The content of mercury in the S sludge was 15.4 ppm in dried sludge and more than 14.6 microgram/liter of mercury is in liquid state in the natural hydrated sludge (liquation rate, 9.5%). This result indicates that mercury present is much greater than that in other soils or in spa water.--Copyright 1973, Biological Abstracts, Inc. W73-14661

#### 5B. Sources of Pollution

THE LIMNOLOGY OF TWO DISSIMILAR SUB-

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THE LIMNOLOGY OF TWO DISSIMILAR SUB-ARCTIC STREAMS AND IMPLICATIONS OF RESOURCE DEVELOPMENT, Alaska Univ., College. Inst. of Water Resources. J. D. LaPerriere, and D. Nyquist. Available from the National Technical Informa-tion Service as PB-223 353, 53.75 in paper copy, \$1.45 in microfiche. Report No. IWR-33. March, 1973. 73 p, 21 fig, 10 tab, 3 append. OWRR B-017-ALAS (1).

Descriptors: Streams, \*Nutrients, Physical pro-Descriptors: Streams, "Neurients, rayscal pro-perties, Chemical properties, "Benthos, Aquatic drift, "Dissolved oxygen, "Alaska, Subarctic, Mayllies, Coddisflies, Diptera, Biochemical ox-ygen demand, "Invertebrates. Identifiers: Goldstream Creek (Alas), Chatanika River (Alas).

The Chatanika River and Goldstream Creek, two subarctic streams which lie in roughly parallel val-leys in interior Alaska, but that differ in size of watershed, elevation, geomorphology and vegeta-tion were studied over an eighteen month period. Both streams are currently free of human manipulation. Various chemical and physical parameters were measured approximately monthly for four-teen months at nine stations on the Chatanika River and five stations along Goldstream Creek. The benthic macroinvertebrate organisms were studied to elucidate relationships between selected parameters and their appearance in drift and Surber samples. A strong time dependance overshadowed all other relationships. The occurrences of specific macroinvertebrates in each stream and of the species diversity of each sample are presented. The dissolved oxygen regime of these two streams was also studied. Dissolved oxygen data taken approximately bimonthly are presented as are tables of biochemical oxygen de-mand in which samples were incubated both at 5C W73-14203

SELECTED PESTICIDES IN AQUATIC FUNGI IN THE THREE RIVERS AREA, Michigan State Univ., East Lansing. Dept. of Botany. For primary bibliographic entry see Field 05A. W73-14207

ROUND HORIZONTAL THERMAL-BUOYANT JET IN A CROSS FLOW, Washington Univ., Seattle. Dept. of Civil En-

gineering.

R. E. Nece, and J. D. Littler.

A vailable from the National Technical Information Service as PB-223 376, \$3.50 in paper copy, \$1.45 in microfiche. Technical Report No. 34, June 1973. 55 p, 30 fig, 13 ref, append. OWRR A-056-WASH (1).

Descriptors: \*Thermal pollution, \*Jets, Diffusion, Hydrodynamics, Flow, Temperature, Velocity, Water temperature, \*Flow rates, Froude number, \*Boundary processes. Identifiers: \*Cross flow, \*Buoyant jets.

Results are presented for an experimental study of round buoyant jets discharged horizontally into and at right angles to the direction of flow of an unstratified receiving stream. Objectives were to obtain empirical relationships defining the trajectory and near field temperature distribution of such jets. Experimental results are given in the form of dimensionless jet trajectories and center-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution-Group 5B

line temperature elevation above that of the receiving fluid. Experimental data were obtained for jet densimetric Froude numbers (as conventionally defined) of 5, 10, and 15, combined with tionally defined) of 5, 10, and 15, combined with jet discharge/cross flow velocity ratios of 0.5, 1, 5, and 10. The velocity ratio was far more significant in determining the jet behavior than was the den-simetric Froude number. Velocity ratios and Froude numbers tested span ranges commonly en-countered in outfall designs. Experimental parameters, including boundary conditions with the jet being discharged from a circular outfall located close to the bottom of the receiving channel, were intended to be representative of sim-plified approximations of a single-outfall cooling water discharge from a thermal plant located on a river. Effects of the near proximity of the channel bottom and of the small channel depth/jet diameter ratio of 4 were clearly evident in comparison of the results with those of previous cases of jets discharged into cross flows.

W73-14212

PREDICTING AND CONTROLLING RESIDUAL CHLORINE IN COOLING TOWER BLOW-

DOWN,
Pacific Northwest Environmental Research Lab.,
Corvallis, Oreg. National Thermal Pollution
Research Program.
For primary bibliographic entry see Field 05D.
W73-14215

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POLLUTION FROM ANIMAL FEEDLOTS, Kansas State Univ., Manhattan. Dept. of Agricul-

R. I. Lipper. Kansas Water Resources Research Institute, Manhattan, Project Completion Report, Contribution No. 121, May 1973. 19 p, 17 fig, 15 tab, 28 ref. OWRR A-008-KAN (1). 14-01-0001-786.

Descriptors: \*Feedlots, \*Water pollution sources, Runoff, Hydrology, \*Farm wastes, \*Rainfall simulators, Chemical oxygen demand, Biochemi-cal oxygen demand, Nitrogen compounds, Bac-teria, Solid wastes, Water pollution control. Identifiers: \*Beef animals, Characterization.

Two test feedlots, each with an area of 0.05 acre were stocked with beef animals on a finishing ration at a rate of 200 animals per acre (10 steers per test lot). One feedlot was entirely surfaced with concrete, the other only at feedbunk and waterer. Slope was 2 percent. Rainfall was simulated by sprinklers capable of application rates from 0.4 to 2.5 in. per hour. Runoff was measured and sam-2.5 in. per hour. Kunoff was measured and sampled. Runoff rate and volume were compared to application rate and volume. Concentrations of BOD, COD, nitrogen compounds, solids, and bacteria were determined. The effects of certain management practices on runoff characteristics were observed.

W73-14227

RELATIONSHIP BETWEEN EXTRACELLU-RELATIONSHIP BELIVEEN EATRACELLULAR AND CELLULAR PRODUCTION IN THE
SULPHURIC GREEN BACTERIUM
CHLOROBIUM LIMICOLA NADS.
(CHLOROBACTERIACEAE) AS COMPARED
TO PRIMARY PRODUCTION OF TO PRIMARY PRODUCTION OF PHYTOPLANKTON, Bialystok Medical Academy (Poland). Dept. of

For primary bibliographic entry see Field 05C. W73-14245 Biology.

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA

AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT, Atomic Energy Establishment, Cairo (Egypt). Radiation Protection Dept. For primary bibliographic entry see Field 05C. W73-14247

NITROGEN NITROGEN AND PHOSPHORUS IN A STRETCH OF THE GUADALUPE RIVER, TEX-WITH FIVE MAIN-STREAM IMPOUND-

Man 18, Southwest Texas State Univ., San Marcos. H. H. Hannan, W. C. Young, and J. J. Mayhew. Hydrobiologia, Vol 41, No 3, p 419-441, May 15, 1973. 9 fig. 4 tab, 32 ref.

Descriptors: "Nitrogen, "Phosphorus, Pollutant identification, "Reservoir storage, "Texas, "Nutrients, "Water analysis, Water pollution sources, Water pollution effects, Sewage effluents, Water sampling, Chemical analysis, Industrial wastes, Pollutant identification, Fluctuations, Impoundments, Nitrates, Nitrites, Ammonia, Phosphates, Outlets, Treatment facilities, Plant growth, Phytoplankton, Methodology, Cycling nutrients.

Plant growth, Phytoplankton, Methodology, Cycling nutrients.
Identifiers: "Guadalupe River (Tex), "Seasonal variation, Kjeldahl nitrogen, Organic phosphorus, Chlorophyll a, Comal River, Nuphar, Philodendron, Lake Gonzales, Eichornia crassipes, Lake Wood, Meadow Lake, Lake McQueeney, Lake Dunlap, Ludwigia, Dissolved nitrogen, Dissolved phosphorus.

Nitrogen and phosphorus were studied in a 168-km stretch of the Guadalupe River that had five maintream impoundments. Flow through the study area was controlled by releases from these five reservoirs and from Canyon Reservoir, a deepstorage reservoir, located 30 km upstream. Parameters measured monthly on a diel basis at 16 stations were nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, Kjeldahl nitrogen, inorganic monia nitrogen, Neidani nitrogen, inorganic phosphate phosphorus, organic phosphate phosphorus, and total phosphate phosphorus. In-organic nitrogen concentrations observed were as high or higher than that previously reported for other bodies of water. Nitrate nitrogen, in general, other bothes of water. Nitrate introgen, in general, reached seasonal minima in summer and maxima in winter. Nitrite nitrogen showed considerable variation with no meaningful pattern except that higher concentrations occurred in association with high chlorophyll a and high Kjeldahl nitrogen, rehigh chlorophyll a and high Kjeldahl nitrogen, regions and periods of low river flow, and large phytoplankton populations. There was no increase in concentration of any form of nitrogen in the vicinity of sewage outfalls and no downstream accrual. Phosphorus levels in the study area were as high or higher than those reported in studies of other bodies of water. Total phosphate phosphorus was the most critical phosphate phosphorus was the most critical phosphate. parameter in assessing eutrophication. Seasonally, it ranged from a winter high to a summer low. Concentrations were highest immediately below sewage outfalls and decreased as water progressed downstream. Inorganic-phosphate-phosphorus concentrations showed no clear seasonal trend but were clearly associated with sewage outfalls. Total organic phosphate phosphorus varied seasonally, with high concentrations occurring during the spring and low concentrations in the fall, showed no correlation with sewage outfalls, but was correlated to a degree with total Kjeldahl nitrogen and chlorophyll a. No consistent pattern of diel fluc-tuations was evident for any phosphorus or nitrogen compounds analyzed. (Holoman-Battelle) W73-14249

THE LIMNOLOGY OF NITROGEN IN AN OKLAHOMA RESERVOIR: NITROGENASE ACTIVITY AND RELATED LIMNOLOGICAL FACTORS.

Oklahoma State Univ., Stillwater. Dept. of Zoolo-

For primary bibliographic entry see Field 05C. W73-14253

NAME OF THE WARD OF THE STATE O

MICROBIOLOGY OF WATER,

Environmental Protection Agency, Cincinnati, Ohio. Water Supply Research Lab. F. F. Geldreich

Journal Water Pollution Control Federation, Vol 45, No 6, p 1244-1259, June 1973. 108 ref.

Descriptors: \*Bibliographies, \*Bioindicators, \*Bacteria, \*Water quality, \*Waste water (Pollution), \*Reviews, Rivers, Coliforms, Mercury, Domestic wastes, Industrial wastes, Heavy metals, Estuaries, Lakes, Ponds, Sea water, Streptococcus, E. coli, Vegetable crops, Tracers, Feed lots, Agricultural runoff, Salmonella, Chlorides, Yeasts, Salinity, Population, Algae, Water temperature, Bicarbonates, Phosphates, Sulfates, Nitrogen fixation, Sediments, Acid mine water, Radioactivity techniques, Dissolved oxygen, Ammonia, Nitrites, Nitrates, Phytoplankton, Stratification, Hydrogen ion concentration, ygen, Animoma, Mittee, Nitrates, Phytopians-ton, Stratification, Hydrogen ion concentration, Rain, Organic matter, Sampling, Equipment, Microbial degradation, Aldrin, DDT, Water pollu-tion effects, Manganese, Potable water, Reser-voirs, Cycling nutrients, Monitoring, Ground-water, Viruses, Oil, Oil pollution, Isolation, Chla-

water, Viruses, Oil, Oil pollution, Isolation, Chlamydomonas, Clostridium.
Identifiers: Culture media, Differential media, Membrane filters, Most probable number test, Fecal coliforms, Nile River, Ismolia Canal, Fecal streptococcus Streptococcus bovis, Streptococcus faecium var. casseliflavus, Aeromonas hydrophila, Streptococcus equinus, Streptococcus avium, Pseudomonas aeruginosa, Staphylococcus avium, Pseudomonas aeruginosa, Staphylococcus avium, Pseudomonas aeruginosa, Staphylococcus avium, Pseudomonas aeruginosa. aeruginosa, Staphylococcus aureus, Bacillus, Ser-ratia marcescens, Chemoluminescence, Aerobacter aerogenes, Fluorescence spec-trophotometry, Shigella dysenteriae, Rhodotorula glutinis, Bdellovibrio bacteriovorous, Vexillixera, Agarbacterium, Pythium debaryanum, Salmonella typhosa, Pseudomonas acidophilia, Thiobacillus ferrooxidans, Sugars, Particulate matter, Gallionella ferruginea, Saprolegniaceae, Aerobacter aerogenes, Pseudomonas fluorescens, aerogenes, Pseudomonas Ituorescens, Aeromonas, Commonas, Herellea, Flavobacter, Enterobacter, Klebsiella, Clostridium perfringens, E. coli communae, E. coli citrovorum, Acinetobacter, Achromobacter, Flavobacterium, Xanthomonas, Chromobacterium, Alcali.

Literature from 1972 concerning microbiological methods for water and wastes is reviewed. Topics include culture media, adequacy of methods for detecting fecal pollution, microbiological indicators for mercury, use of microorganisms for tracing water movement, rapid methods for determing bacterial quality of water, and microbiology of rivers, lakes, ponds, reservoirs, potable water, estuaries, and coastal waters as influenced by various types of pollution. (Little-Battelle)

MICROBIOLOGY - WATERBORNE OUT-National Environmental Research Center, Cincin-For primary bibliographic entry see Field 05C. W73-14262

MICROBIOLOGY-DETECTION OF BACTERI-AL PATHOGENS AND THEIR OCCURRENCE, National Environmental Research Center, Cincin-For primary bibliographic entry see Field 05A. W73-14263

MICROBIOLOGY-DETECTION AND OCCUR-RENCE OF VIRUSES, nal Environmental Research Center, Cincinnati. Ohio. For primary bibliographic entry see Field 05A. W73-14264

AQUATIC SEDIMENTS, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 05C.

# Field 05—WATER QUALITY MANAGEMENT AND PROTECTION Group 5B—Sources of Pollution

W73-14265

MARINE AND ESTUARINE POLLUTION, California State Univ., Long Beach. Dept. of Biology.

Journal Water Pollution Control Federation, Vol 45, No 6, p 1310-1319, June 1973. 125 ref.

Descriptors: "Water pollution, "Water pollution effects, "Estuarine environment, "Reviews, Oil pollution, Sea wter, Invertebrates, Marine algae, "Bibliographies, Bioindicators, Water quality, Waste water (Pollution), Industrial wastes, Thermal pollution, Path of pollutants, Water pollution sources, Red tide, Phytoplankton, Oil spills, Toxicity, Esturaries, Heavy metals, Protozoa. Identifiers: "Marine environment, Macroinve,

sources, Red tue, Phytopiankton, Oil spins, Toxicity, Esturaries, Heavy metals, Protozoa.

Identifiers: "Marine environment, Macroinve, Foraminiferartebrates, Bay of Conception, Chemical oceanography, Physical oceanography, Polychaetes, Enteromorpha, Spiochaetopterus.

Topics discussed in this literature review of marine and estuarine pollution are: bioindicators, thermal pollution; toxicity and pathology; oil pollution; biological and chemical effects (bioassays); bioaccumulation; pathogenic bacteria; chemical analyses of organisms for pollutants; and physical and chemical oceanography. (Holoman-Battelle) W73-14266

HEAVY METALS: A REVIEW OF LEAD,

Illinois Univ., Urbana. S. S. Shukla, and H. V. Leland. Journal Water Pollution Control Federation, Vol 45, No 6, p 1319-1331, June 1973. 118 ref.

Descriptors: \*Lead, \*Toxicity, \*Path of pollutants, \*Water pollution effects, \*Bibliographies, \*Water pollution sources, Animal pathology, Ecological distribution, Public health, Waste water (Pollution), Soil contamination, \*Heavy metals, Air pollution, Water pollution, Great Lakes, Ice cover, Insecticides, Pesticide drift, Arsenicals (Pesticides), Pollutants, Atmosphere, Aerosols, Highways, Rainfall, Urban runoff, Storm runoff, Industrial wastes, Surface drainage, Lake Erie, Lake Michigan, Lake Ontario, Freshwater, Lakes, Streams, Organic matter, Bottom sediments, Lake sediments, Freshwater fish, Marine fish, Zooplankton, Marine animals, Marine fish, Zooplankton, Marine animals, Phaeophyta, Marine algae, Aquatic algae, Lake Superior, Igneous rocks, Metamorphic rocks, Leaching, Sedimentary rocks, Sediment-water interfaces, Waste disposal, Chemical wastes, Surface runoff, Gasoline, Reviews.

Identifiers: Pollutant effects, Chemical concentration, Metal complexes, Biological magnification, Dissolved organic matter, Lithosphere, Hydrosphere, Anodic stripping voltammetry, Particulate matter.

This literature review on lead covers toxicity and sources of lead pollution along with the concentrations associated with each source. (Holoman-Battelle) W73-14267

THERMAL EFFECTS, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W73-14268

EUTROPHICATION, New York State Dept. of Environmental Conservation, Stony Brook. For primary bibliographic entry see Field 05C.

ASBESTOS FIBERS IN BEVERAGES, DRINK-ING WATER, AND TISSUES: THEIR PASSAGE THROUGH THE INTESTINAL WALL AND MOVEMENT THROUGH THE BODY, Department of National Health and Welfare, Ottawa (Ontario). Food and Drug Research Lab. For primary bibliographic entry see Field 05A. W73-14275

POLYCHLORINATED TERPHENYLS AS POTENTIAL CONTAMINANTS OF ANIMAL PRODUCTS, Agricultural Research Service, Beltsville, Md. Agricultural Environmental Quality Inst. For primary bibliographic entry see Field 05A. W73-14277

THE GENERAL CIRCULATION OF WATER IN LAKE CHAD, Office de la Recherche Scientifique et Technique Outre-Mer, Fort-Lamy (Chad), For primary bibliographic entry see Field 02H. W73-14279

SOURCES AND SINKS OF NITROGEN AND PHOSPHORUS: WATER QUALITY MANAGE-MENT OF LAKE GEORGE (N.Y.), Rensselaer Polytechnic Inst., Troy, N.Y. D. B. Aulenbach, and N. L. Clesceri. In: Water-1972, AICHE Symposium Series No 129, Vol 69, p 253-262, 1973. 1 fig. 3 tab, 21 ref.

Descriptors: \*Phosphorus, \*Nitrogen, \*Sinks, \*Water pollution sources, Precipitation (Atmospheric), Waste water (Pollution), Streamflow, Sewage effluents, Path of pollutants, Nutrients, Water quality control, Chemical precipitation, Trophic level, Oligotrophy, Mesotrophy, Bottom sediments, Lake morphology, Discharge (Water), Runoff, Lake sediments, Surface waters, \*New York\*

Identifiers: \*Lake George (NY), \*Nutrient sources, Fate of pollutants, Accumulation.

Measurements were made of the nitrogen and phosphorus contents of the precipitation, stream runoff, and wastewater discharges tributary to Lake George; the lake water itself; and the equivalent of the outlet at Ticonderoga. The major source of nitrogen to the lake is the precipitation which falls directly on the lake. The major source of phosphorus is from wastewater discharges on the watershed. Apparently both the nitrogen and the phosphorus are precipitated and accumulated in the bottom sediments. The concentration of phosphorus in the lake is approaching the critical level of 10 micrograms/1. Removal of phosphorus from wastewater is recommended. (Holoman-Battelle)

PRELIMINARY SURVEY OF MERCURY AND OTHER METALS CONTAINED IN ANIMALS FROM THE FRASER RIVER MUDELATS, British Columbia, Univ., Vancouver. Inst. of Oceanography.
T. R. Parsons, C. A. Bawden, and W. A. Heath. Journal of the Fisheries Research Board of Canada, Vol 30, No 7, p 1014-1016, July 1973. 1

Descriptors: "Heavy metals, "Chemical analysis, Estuarine environment, Water pollution sources, "Benthic fauna, "Pollutant identification, Crabs, "Mercury, Estuaries, Cadmium, Cobalt, Copper, Manganese, Nickel, Zinc, Lead, Colorimetry, Oysters, Marine animals, Mussels, Biological communities, "Canada. Identifiers: "Fraser River estuary, "Animal tissues, Bioaccumulation, Sample preparation, Silver, Flameless atomic absorption spectrophotometry, Cancer magister, Cowichan Bay, Kitimat Arm, Mya arenaria, Crassostrea gigas.

Additional research has been directed toward answering the question of the source of mercury contamination in the Fraser River estuary. The Fraser River mudflat community was divided into two areas from which crabs were collected for Hg analysis. Crabs and other marine organisms were also collected from other areas for comparative analyses. Soft tissse was freeze-dried, powdered, digested with concentrated HNO3, evaporated to dryness, diuted with 1.5 M HCl., and analyzed by atomic absorption spectrophotometry for Ag, Cd, Co, Cu, Ma, Ni, and Zn. Pb analysis was done colorimetrically and Hg was analyzed by flameless AAS after sample digestion using sulfuric acid and hydrogen peroxide. Benthic animals from Sturgeon Bank contained larger amounts of mercury and other metals than animals from similar environments on the coast of British Columbia. These high levels of metals are believed to be associated with the Vancouver City sewer outfall. (Holoman-Battelle)

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DISCHARGE OF NITRILOTRIACETATE (NTA) FROM TWO SEWAGE TREATMENT FACILITIES LOCATED IN A MIDCONTINENTAL CLIMATE.

Fisheries Reasearch Board of Canada, Winnipeg (Manitoba). Freshwater Inst. J. W. M. Rudd, B. E. Townsend, and R. D. Hamilton.

Journal of the Fisheries Research Board of Canada, Vol 30, No 7, p 1026-1030, July 1973. 2 fig, 2 tab, 10 ref.

Descriptors: \*Nitrilotriacetic acid, Treatment facilities, \*Sewage effluents, \*Acrated lagoons, \*Activated sludge, \*Discharge measurement, Sewage treatment, Water pollution sources, Biochemical oxygen demand, Effluent streams, Influent streams, Dissolved oxygen, Pollutants, Pollutant identification, \*Canada.

Identifiers: \*Degradation rates, Red River, Assinboine River, Chemical concentration.

Concentrations of NTA entering the Red and Assiniboine rivers from two Winnipeg sewage treatment facilities were monitored. The activated sludge plant usually discharged less than 0.5-mg NTA/liter throughout the year. The aerated sewage lagoon discharged less than 20 micrograms NTA/liter during summer. It was believed that the NTA passed through the lagoon essentially unchanged during winter (1800 micrograms NTA/liter) when degradation rates must have been extremely low. No NTA was detected in river water downstream from either of these facilities. It was concluded that even under extreme environmental conditions NTA discharge did not present a hazard to either local aquifers or local biota. (Holoman-Bettelle)

SELECTED METALS IN SEDIMENTS, WATER, AND BIOTA IN THE ILLINOIS RIVER, Bradley Univ., Peoria, Ill. Dept. of Biology. B. J. Mathis, and T. F. Cummings. Journal Water Pollution Control Federation, Vol 45, No 7, p. 1573-1583, July 1973. 3 fig, 7 tab, 20 ref. OWRR A-034-ILL (2).

Descriptors: "Heavy metals, "Bottom sediments, "Tubificids, Clams, Freshwater fish, "Water pollution, "Pollutant identification, Chemical analysis, Absorption, Benthic fauna, Cadmium, Chromium, Cobalt, Copper, Lead, Nickel, Zinc, Water analysis, Oligochaetes, Annelids, Mudwater interfaces, Water pollution effects, Water sampling, Laboratory tests, Aquatic animals, White bass, Carp, Carnivores, Omnivores, Mollusks, Path of pollutants.

Identifiers: "Illinois River, Sample preparation, Atomic absorption spectrophotometry, Bioacculation, Lithium, Dorosoma cepedianum, Animal tissues, Esox lucius, Largemouth bass,

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution-Group 5B

Smallmouth bass, Fate of pollutants, Northern pike, Fingernail clam.

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This study was designed to assess the degree of metal contamination in a large midwestern river. The river is utilized both by industries for manufacturing and waste disposal purposes and by cities as a source of potable water and a means of wastewater disposal. Analyses were made for copper, nickel, lead, chromium, lithium, zincobalt, and cadmium in bottom sediments, water, tubificid annelids, clams, and fishes. Metal concentrations were higher in sediments than in water and organisms. Clams and worms that inhabit the mud or mud-water interface exhibited the highest metal concentrations of any of the organisms. metal concentrations of any of the organisms. Fishes that are primarily carnivorous in nature exrisnes that are primarily carnivorous in nature exhibited lower mean muscle concentrations of copper, nickel, lead, chromium, zinc, and cadmium than did omnivorous fishes. (Holoman-Battelle) W73-14308

MOLYBDENUM CONCENTRATIONS IN TIS-SUES OF RAINBOW TROUT (SALMO GAIRD-NERI) AND KOKANEE SALMON (ONCOR-HYNCHUS NERKA) FROM WATERS DIFFER-ING WIDELY IN MOLYBDENUM CONTENT, Colorado Univ., Boulder. Dept. of Environmental, Population, and Organismic Biology. J. V. Ward.

J. V. waru. Journal of the Fisheries Research Board of Canada, Vol 30, No 6, p 841-842, June 1973. 1 tab,

Descriptors: \*Water analysis, \*Molybdenum, \*Rainbow trout, X-ray fluorescence, Spectrophotometry, Absorption, Heavy metals, Reservoirs, Sockeye salmon. Identifiers: \*Biological samples, \*Bioaccumulation, \*Kokanee salmon, Liver, Kidneys, Testes, Tissue, Ovaries, Spleen, Bone, Muscle, Intestine, Stomach, Brain, Fat, Gills, Salmo gairdneri, Oncophyschus perka

Salmo gairdneri and Oncorhynchus nerka were obtained from Dillon and Eleven Mile Reservoirs and a hatchery in Colorado for analysis of molyba natchery in Colorado for analysis of molyo-denum content. Liver, kidney, testes, ovaries, spleen, bone, muscle, intestine, stomach, brain, fat, and gill samples were analyzed by x-ray fluorescence. Water samples were analyzed spe-trophotometrically. Concentrations of molyb-denum in tissues of rainbow trout increased only slightly with increase in molybdenum concentra-tion of the water. Fish from high (300 ppb) molybtion of the water. Fish from high (300 ppb) molybdenum water had mean concentrations of 13-332 ppb on a wet-weight basis; those from low (6 ppb) molybdenum water, 10-146 ppb; and those from trace molybdenum water, 5-118 ppb. Rainbow trout exhibited generally higher molybdenum concentrations than did kokanee salmon in high molybdenum water. A possible plateau mechanism concerning molybdenum accumulation by salmonids is discussed. (Little-Battelle) W73-14309

SUMMER ALGAL COMMUNITIES AND PRI-MARY PRODUCTIVITY IN FISH PONDS, Alabama Agricultural Experiment Station, Au-

For primary bibliographic entry see Field 05C. W73-14315

DETERGENTS.

Matz, Childs, and Associates, Baltimore, Md. Journal Water Pollution Control Federation, Vol 45, No 6, p 1059-1063, June 1973. 23 ref.

Descriptors: \*Detergents, \*Waste water treat-ment, \*Reviews, \*Bibliographies, Water pollution effects, Water pollution sources, \*Surfactants, Biodegradation, Nutrient removal, Environmental

effects, Nitrilotriacetic acid, Water pollution, Toxicity, E. coli, Lethal limit, Bioassay, Temperature, Water quality, Linear alkylate sulfonates, Groundwater, Carbonates, Phosphates, Laboratory tests, Striped bass, Microbial degradation, Waste water (Pollution), Domestic wastes, Indus-

Identifiers: Detergent-builders, Fate of pollutants, Quahog, Mercenaria mercenaria, Grass shrimp, Palaemonetes vulgaris, Histopathology, Sand-worms, Anionic detergents, Anionic surfactants, Porgies, Degradation products, Dodecylsulfate, Dodecylbenzene sulfonate, Methylene blue active substance, Pinus sylvestris, Hermit crabs, Mun-nichoes, Scupa

This literature review on detergents is concerned with the (1) detergent builders - their toxicity, impact on water quality, and biodegradation; (2) anionic surfactant concentrations and biodegradation; and (3) the removal of surfactants from wastewater. (Holoman-Battelle) W73-14319

WATER QUALITY MONITORING ON THE MISSISSIPPI RIVER HAS ITS PITFALLS, Saint Louis Metropolitan Sewer District, Mo.

B. A. Rains, and R. S. Flick.
In: Water-1972, AICHE Symposium Series No. 129, Vol 69, p 401-413, 1973. 11 fig, 4 tab.

Descriptors: "Water quanty, mources, "Water pollution sources, "Water pollution sources, "Water sampling, Equipment, "Methodology, Environment, "Mississippi Descriptors: \*Water quality, \*Monitoring, Natural samping, Equipment, "Methodology, Environ-mental effects, Flow measurement, "Mississippi River, Chemical analysis, Water analysis, Waves (Water), Phenols, On-site data collections, Discharge (Water), River flow, Water tempera-ture, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Suspended solids, Annual, Pollutant identifica-Identifiers: Biological samples, Fecal coliforms.

The difficulties and problems associated with sampling a large stream such as the Mississippi River to determine biological and chemical quality are discussed. Included is information on sampling point selection, methods of sample collection, flow measurement technique, and pollution source location. Field equipment and laboratory results obtained from sample analysis are described. (Holoman-Battelle) W73-14320

THE METABOLISM OF LONG-CHAIN FATTY ACIDS AND ALCOHOLS BY CANDIDA TROPI-CALIS AND SACCHAROMYCES CEREVISIAE, For primary bibliographic entry see Field 05C. W73-14325

DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO, Geological Survey, Arlington, Va. For primary bibliographic entry see Field 07B. W73-14354

ECOLOGICAL EVALUATION OF MULTIUSE WATERS RECEIVING PRIMARY TREATMENT EFFLUENT PRIOR TO A MAJOR FLOW IN-CREASE, Connecticut Univ., Storrs. Inst. of Water Resources. For primary bibliographic entry see Field 05C. W73-14361

THE COMPUTER-SYSTEMS APPROACH TO ENVIRONMENTAL PROTECTION, PLANNING AND MANAGEMENT: THE MALIBU WATERSHED,
California Univ., Los Angeles. School of Public

E. S. Flowers, and D. May.

Available from the National Technical Informa-tion Service as PB-223 559, \$4.25 in paper copy, \$1.45 in microfiche. Water Resources Center, University of California, Davis, Contribution No. 136, December, 1971. 113 p, 11 fig, 197 ref, 2 ap-pend. OWRR A-038-CAL (2). UCAL-WRC-W-330.

Descriptors: \*Computer models, \*Systems analysis, Environmental control, \*Water quality, \*California, \*Model studies. Identifiers: \*Malibu watershed (Calif).

Computer models are described in hydrology, water quality, ecology, behavioral systems, and data management prepared as a part of a mul-tidisciplinary project studying the environment of the Malibu watershed. Over one hundred models have been selected and described from the litera-ture, and possible applications of the models to the protection, planning and management of the Malibu watershed are discussed in terms of an environmental systems approach. The objective has been to describe computer methods, techniques, software, and possible application of computer systems to general environmental systems with emphasis on the water resource. W73-14371

EFFECT OF SILT AND SILT REMOVAL IN A PRAIRIE LAKE,
Dakota State Coll., Madison, S. Dak. Dept. Biology; and Dakota State Coll., Madison, S. Dak. Dept. of Chemistry. For primary bibliographic entry see Field 05C. W73-14373

RESPONSE OF SALINITY SENSORS TO RAPIDLY CHANGING SALINITY, Agricultural Research Service, Riverside, Calif. For primary bibliographic entry see Field 02G. W73-14417

DIERNAL SOIL-WATER EVAPORATION: CHLORIDE MOVEMENT AND ACCUMULA-TION NEAR THE SOIL SURFACE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W73-14422

PRODUCTION, POLLUTION, PROTECTION, W. B. Yapp. Wykeham Publication, Ltd: London, England; Springerverlag: New York, N.Y., 1972. 181 p Il-lus, Maps, Paper, Pr \$5.80.

Identifiers: Animals, Books, Food chains, Land use, Pesticides, \*Pollution, \*Production, Protec-tion, Radiation, \*Water pollution control, Water

Whole-organism biology, as opposed to special-ized aspects of biology, such as molecular biology, is discussed. How organic matter is made and conis discussed. How organic matter is made and con-verted from one form to another is discussed. Top-ics such as synthesis and food chains, primary production, conversion, definitions and practical methods, the factors of production and the biotic factors of production are all discussed. A discus-sion on how man has, deliberately or accidentally, interfered with the natural flow of production is presented. Grazing, destruction of animals, cul-tivation of crops, cropping of animals and land use are considered. How man has polluted the en-vironment is stressed. Terrestrial pollution, at-mospheric pollution, organic matter, pollution of the sea, pesticides and radioactive wastes are discussed. The possible ways in which man may protect himself from mismanagement of nature's resources are presented.—Copyright 1973, Biologi-cal Abstracts, Inc. verted from one form to another is discussed. Top-

#### Group 5B-Sources of Pollution

EXAMINATION OF ULTRASTRUCTURE AND GROWTH OF THE CELL WALL OF SPYRIDIA FILAMENTOSA (WULF.) HARV., UNTER-SUCHUNGEN UBER BAU UND WACHSTUM DER ZELLWANDE VON SPYRIDIA FILAMEN-TOSA (WULF.) HARV.), Thessaloniki Univ., Salonika (Greece). Botanical

For primary bibliographic entry see Field 05C. W73-14439

DETRITUS IN LAKE TAHOE: STRUCTURAL MODIFICATION ATTACHED MICROFLORA, California Univ., Davis. Inst. of Ecology.

For primary bibliographic entry see Field 05C.

DEEP-SEA MICROORGANISMS: IN SITU RESPONSE TO NUTRIENT ENRICHMENT, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05C. W73-14446

NITRITE REDUCTASE-DEFICIENT MUTANTS

OF ESCHERICHIA COLI K12, Birminham Univ. (England). Dept. of Biochemis-

For primary bibliographic entry see Field 05A. W73-14450

WASTE DISPOSAL IN NATURAL WATER-

WAYS, Harvard Univ., Cambridge, Mass. Dept. of Sanitary Engineering. For primary bibliographic entry see Field 05G.

PLANT PHENOLS AND RELATED ORGANIC COMPOUNDS IN PUBLIC WATER SOURCES, THEIR RELATIONSHIP TO CHLORINATION, Rhode Island Univ., Kingston. Dept. of Pharmacology.

Available from the National Technical Information Service as PB-223 566, \$2.75 in paper copy, \$1.45 in microfiche. Rhode Island Water Resources Center Final Report, 1973. 12 p, 4 tab. OWRR A-041-RI (1). 14-31-0001-3840.

Descriptors: \*Phenols, \*Chlorination, \*Toxicity, Water supply, \*Organic compounds, \*Amino acids, Water pollution sources, Water pollution ef-

In the investigation of interaction between organic pollutants and active chlorine in water, hydroxycinnamic acids were found to afford various chlorinated styrene and chlorinated quinone derivatives. Phenolic amino acids tyrosine gave chlorinated benzyl acetonitrile derivatives. Furthermore, it was discovered that, in general, free amino acids afford nitrile derivatives even in a very high dilution. To evaluate the possible effects of the products to human and ecological systems, antimicrobial, molluscicidal activities and acute toxicities to mice were investigated. In each case, mild activity was observed with most of the com-

INTERCEPTION AND DEGRADATION OF PESTICIDES BY AQUATIC ALGAE,
Rhode Island Univ., Kingston. Dept. of Pharmacology.
For primary bibliographic entry see Field 05C.

W73-14469

W73-14458

CANADARAGO LAKE EUTROPHICATION: PHOSPHORUS ALONG A SECTION OF

PROSPRORUS ALONG A SECTION OF OCQUIONIS CREEK, New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit. For primary bibliographic entry see Field 05C. W73-14537

HISTORY OF THE SOUTH CAROLINA

OYSTER, South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Center. For primary bibliographic entry see Field 02L. W73-14589

LOUISIANA SUPERPORT STUDIES--REPORT 2, PRELIMINARY ASSESSMENT OF THE EN-VIRONMENTAL IMPACT OF A SUPERPORT ON THE SOUTHEASTERN COASTAL AREA OF

Louisiana State Univ., Baton Rouge. Dept. of Marine Science.

Marine Science.

J. H. Stone.

Available from NTIS, Springfield, Va. 22151 as
COM-73-10544, Price \$6.00 printed copy; \$1.45
microfiche. Louisiana State University, Baton
Rouge, Center for Wetland Resources Report LSU-SG-72-05, 1972. 345 p, 79 fig, 110 tab, 15 ref.

Descriptors: "Harbors, "Oil spills, "Water pollution effects, "Ecosystems, "Louisiana, Gulf of Mexico, Environmental effects, Biology, Aquatic life, Coasts, Estuaries, Ecology, Model studies, Tidal effects, Sediment transport, Engineering structures, Planning, Projections, Forecasting, Path of pollutants, Winds, Ocean currents, Littoral drift, Surveys, Continental shelf. Identifiers: \*Superport construction planning (La).

The objectives were (1) to conduct an overall environmental evaluation of a Superport operation at two hypthetical locations on the continental shelf off the southeast coast of Louisiana, (2) to establish wihin the limits of available data the existing environmental conditions at and around the proposed sites, and (3) to predict and/or document (a) the effects of an oil spill at or near the proposed sites and (b) the effects of operations. Oil-drift projections indicate that the site more distant from shore would have less effect because a potential spill there would probably not reach the estuarine spin intere would productly not reach the estuatine areas. Oil-drift projections of hypothetical oil spills are based on a hydrodynamical numerical model using wind conditions, local tides, and bathymetry. At the closer offshore site oil spills moved either northwest toward Timbalier Bay or northeast toward Barataria Bay. Oil spills at the farther offshore site did not impinge on the shorelines nor into the estuaries. Potential adverse effects resulting from an oil spill would be most severe in the estuaries. Oil could damage or kill extensive areas of marsh grass, thereby reducing or eliminating the most important food source for the major consumers, which are fishery species. Damage to the Gulf shoreline would probably be minimal unless the oil concentrated in the littoral currents, which are also used as a migratory aid.
(Woodard-USGS) W73-14592

STUDENT PROJECTS ON COASTAL ZONE AND OFFSHORE RESOURCES MANAGE-MENT, Massachusetts Inst. of Tech., Cambridge. For primary bibliographic entry see Field 02L. W73-14615

AQUATIC INSECT COMMUNITIES IN THE RIVERS OF THE YORO, OBITSU, AND ISUMI, CHIBA PREFECTURE, JAPAN, (IN CHIBA PARTE STATE STATE

H. Tanaka. Bull Freshwater Fish Res Lab Tokyo. Vol 21, No Bull Freshwater Fish Res Lab Tokyo. vol 21, No 1, p 21-35. 1971. Illus. (English summary). Identifiers: "Aquatic insects, Bactis-Sp. Bamboo, Caddis-Fly, Indicators, Industrial wastes, Inver-tebrates, Isonychia-Japonica, "Japan (Chiba pre-fecture), Pollution, Rivers, Waste water, "Water rollution index."

In Nov. 1968, 23 stations were selected along three in NOV. 1908, 25 stations were selected along three rivers that flow through sandstone areas and aquatic insect communities found there were investigated. The geographic and topographical features of the rivers are shown and water quality was observed. Insects were collected on the stony bed riffles and in the partially submerged bamboo bushes on the banks. Species (50) of insects and 9 bushes on the banks. Species (30) of insects and 9 species of other invertebrate animals were collected at the Yoro River. At the Obitsu River, 40 species of insects and 3 species of other invertebrate animals were collected. Finally, 34 species of insects and 8 species of other invertebrate animals were collected at the Isumi River. As many as 25 species of insects were found in all rivers. In all rivers, free-swimming mayflies showed predominant tendency, while the subshowed predominant tendency, while the sub-sistence density of net-spinning caddis-flies was extremely low. In the majority of insects, practi-cally no habitat preference was evident. Bactis sp. appear to be comparatively resistant against pollu-tion by inorganic suspended matter. The aquatic areas were divided into 4 degrees, A-D, of pollution on the basis of number of species of insect communities at the stony bottom and the partially submerged bamboo. The assessment of water pol-lution of the sandy bed rivers attempted on the basis of the insect communities found in the par-tially submerged bamboo bushes is likely to be used in the future as one of the biological assessused in the future as one of the biological assessment methods of water pollution.--Copyright 1973, Biological Abstracts, Inc. W73-14617

TIME SENSING AND ANALYSIS OF COASTAL

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 02L. W73-14631

TURBIDITY, TRANSPARENCY AND COLOR OF WATER IN THE ESTUARY AREA (MUTNOST', PROZRACHNOST' I TSVET VOD VZ-

For primary bibliographic entry see Field 02L. W73-14637

ATERAL DIFFUSION IN A TIDAL ESTUARY, Baghdad Univ. (Iraq). Coll. of Engineering. For primary bibliographic entry see Field 02L. W73-14647

SOME ASPECTS OF THE OCEANOGRAPHY OF LITTLE PORT WALTER ESTUARY, BARANOF ISLAND, ALASKA, Michigan Univ., Ann Arbor. Great Lakes Michigan Un Research Div.

For primary bibliographic entry see Field 02L. W73-14665

EXPERIMENTAL STUDY OF WATERFLOOD TRACERS, Jersey Production Research Co., Tulsa, Okla

Ti Si mi de space ra wibli ra re

For primary bibliographic entry see Field 02E. W73-14727

#### 5C. Effects of Pollution

THE LIMNOLOGY OF TWO DISSIMILAR SUB-ARCTIC STREAMS AND IMPLICATIONS OF RESOURCE DEVELOPMENT, Alaska Univ., College. Inst. of Water Resources. For primary bibliographic entry see Field 05B. W73-14203

RELATIONSHIP BETWEEN EXTRACELLULAR AND CELLULAR PRODUCTION IN THE
SULPHURIC GREEN BACTERIUM
CHLOROBIUM LIMICOLA NADS.
(CHLOROBACTERIACEAE) AS COMPARED
TO PRIMARY PRODUCTION OF PHYTOPLANKTON.

Bialystok Medical Academy (Poland). Dept. of Biology.

Bi. Czeczuga, and F. Gradzki. Hydrobiologia, Vol 42, No 1, p 85-95, July 6, 1973. 7 fig, 1 tab, 28 ref.

Descriptors: \*Primary productivity, \*Organic matter, \*Bacteria, \*Phytoplankton, Photosynthes-is, Bioassay, Carbon, Radioactivity techniques, Photosynthetic bacteria. Identifiers: \*Chlorobium limicola, \*Poland, Sam-

ple preparation, Organic carbon, Wadolek Lake.

Dark and double light bottles containing Chlorobi-um limicola and phytoplankton from two stands were immersed in Wadolek Lake at depths of 0 to 7 m to study the quantities of substances formed during photosynthesis both inside and outside the cells. Each bottle was spiked with C-14-labelled NaCO3. Assimilation of carbon and quantities of substances filtering outside the cells were also determined in the dark bottles. After one day at any depth, formalin was added to each bottle and the contents filtered to separate algal cells from Chlorobium bacteria. After drying of the filters, the residue was measured with a Geiger-Mueller counter. To measure extracellular matter, a por-tion of the contents of each bottle was put on an aluminum plate, evaporated and the activity measured. Mean values of extracellular production of phytoplankton were 58.4 percent (stand II) and 65.2 percent (stand I) of cellular production, and for extracellular production of Chlorobium limicola the values were respectively 44.7 percent (stand II) and 70.7 percent (stand I). On the average 70.8 percent of carbon assimilated in the dark filtered outside the cell in case of phytoplank-ton, and 31.0 percent in the case of Chlorobium limicola. Extracellular and cellular production in case of phytoplankton and Chlorobium limicola was calculated for I square meter of the water column. (Little-Battelle)

UPTAKE OF RADIONUCLIDES BY SOME AQUATIC MACROPHYTES OF ISMAILIA CANAL, EGYPT, Atomic Energy Establishment, Cairo (Egypt).

Radiation Protection Dept.

W. E. Y. Abdelmalik, R. M. K. El-Shinawy, M. M. Ishak, and K. A. Mahmoud.
Hydrobiologia, Vol 42, No 1, p 3-12, July 6, 1973. 5

tab. 10 ref.

Descriptors: \*Bioassay, \*Radioactive wastes, \*Bioindicators, Aquatic plants, Absorption, Water pollution effects, Radioisotopes, Algae, Sago pondweed, Mathematical studies, Chara. Identifiers: \*Bioaccumulation, Cs-134, Co-60, Sr-

90, P-32, Elodea densa, Ceratophyllum demersum, Potamogeton pectinatus, Ismailia Canal, \*Egypt, Waterweeds, Hornworts, Data interpretation.

n

The uptake and accumulation of Cs-134, Co-60, Sr-90, and P-32 were studied with four aquatic macrophytes: Elodea densa, Ceratophyllum demersum, Potamogeton pectinatus, and Chara sp. Tests were conducted with plants in large aquaria containing canal water labelled with the actionactical periodic processing the periodic process of the plants. radionuclides. Periodically, portions of the plants were removed, dipped in running distilled water, blotted on filter paper, weighed, dried, ashed, and radioassayed. Statistical evaluations of the correlation between radionuclide concentration and uptake by the plants led to the following conclu-sions. (1) Uptake of the radionuclides was found to increase at increasing initial concentrations of the

radionuclides in the water. (2) Maximum uptake radionuclides in the water. (2) Maximum uptake was reached by most of the aquatic plants after different periods of contamination, ranging from 1 to 4 days. (3) Ceratophyllum was the most favorable biological indicator for strontium radioistorpes in concentrations ranging from 0.5 to 10 microcuries/I and for contamination periods up to 16 days. (4) Elodea was found to serve as a biological indicator for either strontium or phosphorus radioisotopes for limited contamination periods of 2 to 16 days for Sr and 10 2 days for P isstopes. (5) radioisotopes for limited contamination periods of 2 to 16 days for Sr and to 2 days for P isotopes. (5) Potamogeton was also found to serve as a biological indicator for limited contamination periods for strontium, phosphorus and cesium radioisotopes: 0 to 2 days for Sr, 2 to 16 days for P, and 0 to 2 days for Cs isotopes. (Little-Battelle) W73-14247

ECOLOGICAL STUDIES IN THE PLANKTON OF CERTAIN FRESHWATER PONDS OF HYDERABAD-INDIA. III. ZOOPLANKTON

AND BACTERIA, Osmania Univ., Hyderabad (India). Hydrobiology Lab.

Lao. G. Seenayya. Hydrobiologia, Vol 41, No 4, p 529-540, May 30, 1973. 8 fig, 2 tab, 27 ref.

Descriptors: \*Ecology, \*Biological communities, \*Zooplankton, \*Phytoplankton, \*Bacteria, Animal populations, Organic matter, Water quality, Nutrients, Dominant organisms, Phosphates, Dissolved solids, Crustaceans, Copepods, Water-fleas, Ponds, Rotifers, Rain, Algae, Diatoms, Limiting factors, Chlorella. Identifiers: Chlorophyll a, Organic nitrogen, \*India, Marcinivertebrates, Macrothyix, Chydorus, and Charles, Macrothyix, Chydorus, Marchy, Chydorus, Marchy, Chydorus, Marchy, Chydorus, Chydorus, Charles, Macrothyix, Chydorus, Chydorus, Charles, Macrothyix, Chydorus, Chyd

dia, Macroinvertebrates, Macrothrix, Chydorus, Ceriodaphnia, Simocephalus, Alona, Pleuroxus, Latonopsis, Camptocercus, Chara, Nitella, Microcyclops, Mesocyclops, Ectocyclops, Eucyclops, Diaptomus, Thermocyclops, Periodicity, Euglena haematodes, Nitzschia gracilis, Anabaenopsis raciborakii, Lyngbya mucicola.

The ecological behavior of zooplankton and bacteria were studied in freshwater ponds in India. Populations of the organisms were determined and related to rainfall and several chemical parameters (oxidizable and nitrogenous organic matter, phosphates, and dissolved solids). Cladocerans were more abundant than copepods, rotifers or ostracods in all the ponds investigated. The pond harboring Chara and Nitella had a dense population of Chydorus. Thermocyclops grew abundantly in oxygen-rich water. The pulses of zooplankton preceded those of phytoplankton and the grazing effect was very well marked in one of the ponds. Ponds smaller in dimension harbored denser populations of bacteria. Higher concentra-tions of phosphate, dissolved solids, and oxidizable and nitrogenous organic matter favored their multiplication. Bacterial pulses almost coincided with those of phytoplankton - more precisely with chlorophyll-a. Possibly microbes fed on the freshly liberated materials from the phytoplank-ters. (See also W73-06313) (Little-Battelle) W73-14248

NITROGEN AND PHOSPHORUS IN A STRETCH OF THE GUADALUPE RIVER, TEXAS, WITH FIVE MAIN-STREAM IMPOUND-AS, WIT

Southwest Texas State Univ., San Marcos For primary bibliographic entry see Field 05B. W73-14249

THE LIMNOLOGY OF NITROGEN IN AN OKLAHOMA RESERVOIR: NITROGENASE ACTIVITY AND RELATED LIMNOLOGICAL FACTORS, Oklahoma State Univ., Stillwater. Dept. of Zoolo-

D. W. Toetz.

The American Midland Naturalist, Vol 89, No 2, p 369-380, April 1973. 7 fig, 3 tab, 20 ref. OWRR-A-012-OKLA (4).

Descriptors: "Nitrogen fixation, "Nitrogen cycle, "Nitrification, Water analysis, Water temperature, Nitrates, Nitrotes, Ammonia, Nitrogen, Lakes, Plankton, Cyanophyta, Nutrients, Seasonal, Sediments, Absorption, Enzymes, Secchi disks, "Oklabaca", Secchi disks,

Oklahoma.

Identifiers: \*Nitrogenase, Acetylene reduction, Transparency, \*Lake Carl Blackwell (Oklahoma), Mineralization.

The surface waters of Lake Carl Blackwell. Oklahoma, were assayed, using acetylene reduc-tion techniques, for their N2 fixing potential at in-tervals of 2 to 3 weeks, between November 1969, and July 1971. Data were obtained on limnological factors which affect the rate of N2 fixation; temperature, transparency of the water and concenperature, trainsparency of the water and concentration of nitrate, nitrite and ammonia at meter intervals. The ranges of the rates of ethylene production by concentrated and unconcentrated plankton were 0.1 to 225.6 and 50.6 to 185.4 mooles per mg N hr, respectively. Rates fluctuated widely per mg N nr, respectively. Rates Iluctuated widely during the season and were nil in winter. Acetylene reduction at the surface was associated with the expanding phase of blooms of blue-green algae. Acetylene reduction by the sediments was also observed and uptake of Nitrogen-15 by the plankton verified that an N2 fixing potential exists in the lake. Observations on the seasonal cycle of in the lake. Observations of the season cycle of inorganic nitrogen revealed that nitrification predominated in winter and early spring. Decreases in inorganic N in early summer at the surface were attributed to uptake by autotrophs. Mineralization proceeded after the demise of the autotrophs in autumn. During summer stagnation, nitrate, ammonia and nitrite were stratified, but there was no evidence of denitrification. (Little-W73-14253

THE ENVIRONMENTAL TOXICITY OF CRASSIN ACETATE USING TETRAHYMENA PYRIFORMIS AS A MODEL,

Oklahoma Univ., Norman. Dept. of Zoology. D. L. Perkins, and L. S. Ciereszko. Hydrobiologia, Vol 42, No 1, p 77-84, July 6, 1973. 4 fig. 5 ref.

Descriptors: \*Bioassay, \*Toxicity, \*Protozoa, Reproduction, Growth rates, Ecology, Coral, Animal physiology. Identifiers: Crassin acetate, Tetrahymena pyrifor-

mis, Pseudoplexaura porosa, Mobility.

Crassin acetate, a macrocyclic diterpene lactone, may constitute as much as 1.5 percent of the dry weight of the cortex of the gorgonian Pseudoplex-aura porosa (HOUTTUYN). An amicromucleate strain of Tetrahymena pyriformis was cultured and subjected to various concentrations of the compound to investigate its effect on motility and growth. The effects of the compound were essentially concentration dependent and for concentrations of 0.027 to 0.133 millimoles, they may be summarized as follows: increased generation time from 0 to 14 hours after subculture; decreased population density; decreased motility; and death. The conclusions of this investigation have been extended to include a possible role of the macro-cyclic diterpenes in their natural environment, i.e., crassin acetate and related compounds function in the marine ecosystem by decreasing the viability of ciliated larvae of organisms which compete with the gorgonians for space. (Little-Battelle) W73-14255

TOXICITY ASSESSMENT OF TREATED MU-NICIPAL WASTEWATERS, California Univ., Berkeley. Sanitary Engineering Research Lab. L. A. Esvelt, W. J. Kaufman, and R. E. Selleck.

#### Group 5C-Effects of Pollution

Journal Water Pollution Control Federation, Vol 45, No 7, p 1558-1572, July 1973. 4 fig, 6 tab, 12 ref.

Descriptors: "Bioassay, Waste water (Pollution), Waste water treatment, "Toxicity, "Sewage effuents, "Water pollution effects, Laboratory tests, Freshwater fish, Lethal limit, Mortality, Pilot plants, "Shiners, Sticklebacks, Chemical precipitation, Ion exchange, Activated sludge, Sewage treatment, Biological treatment, Nutrient removal, Pollutants, Ammonia, Organic compounds, Heavy metals, Lead nickel, Cadmium, Copper, Zinc, Sulfides, Phenols, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Hydrogen ion concentration, Phosphorus, Sorption.

Identifiers: Golden shiner, 'Three-spined stickleback, Median tolerance limit, Continuous flow technique, Notemigonus crysoleucas, Gasterosteus aculeatus, Chemical composition, Lime precipitation, Grease, Dechlorination, Clinoptilolite ion exchange, Atomic absorption spectrophotometry, Cyanides, Methylene blue active substance.

Bioassay studies of the toxicity of municipal wastewaters and its removal by conventional and advanced waste treatment processes were conducted with effluents from full-scale and pilot-plant treatment facilities. Wastewater toxicities were determined before and after each treatment process with continuous-flow, on-line bioassays using golden shiners and three-spined sticklebacks. Primary effluent 96-hr TL50 values from four communities averaged about 45 percent. Good correlations were observed between the toxand methylene blue active substance and NH3-H concentrations in primary and treated ef-fluents. Biological treatment with activated sludge at conventional loadings removed most toxicity from primary effluents, and chemical precipitation with lime at pH 11, followed by recarbonation, reduced the toxicity to an average 96-hr TL50 of 75 percent. Further ion exchange and sorption treatments resulted in even less toxic effluents. Chlorination of all effluents resulted in increased toxicity, and dechlorination with sodium bisulfate resulted in the removal of all chlorine-induced tox icity. (Holoman-Battelle) W73-14258

### EFFECTS OF POLLUTION ON FRESHWATER

FISH, National Water Quality Lab., Duluth, Minn. J. M. McKim, G. M. Cristensen, J. H. Tucker, and M. J. Lewis.

Journal Water Pollution Control Federation, Vol 45, No 6, p 1370-1407, June 1973. 375 ref.

Descriptors: "Water pollution effects, "Freshwater fish, "Reviews, "Analytical techniques, "Bibliographies, Methodology, 'Chemical analysis, Heavy metals, Aquatic environment, Ecosystems, Fish physiology, Fish behavior, Stress, Pesticide toxicity, Animal metabolism, Fish reproduction, Water pollution, Fish diseases, Bioassay, Lethal limit, Fish populations, Mortality, Organic wastes, Industrial wastes, Oil spills, Alkaline earth metals. Identifiers: "Animal tissues, Bioaccumulation, Mobilization, Biological magnification, Biomonipine, Samble preparation. Fate of pollutants,

Identifiers: "Animal tissues, Bioaccumulation, Mobilization, Biological magnification, Biomonitoring, Sample preparation, Fate of pollutants, Biotransformation, Guppy, Poecilia recticulatus, Histopathology, Ictalurus punctatus, Ictalurus furcatus, Blue catfish, American eel, Anguilla rostrata, Stizostedion vitreum, Salmo trutta, Species diversity, White sucker, Catostomus commersoni, Oxygen consumption, Dolly varden trout, Sal-

elinus malma

An extensive literature review is presented which is concerned with the effects of pollutants (metals, pesticides, detergents, industrial wastes) on freshwater fish; chemical and biological methods for identifying and determining the effects of such

pollutants; and the effects of the water quality parameters salinity, oxygen, and pH on freshwater fish. (Holoman-Battelle) W73.1429.

MICROBIOLOGY - WATERBORNE OUT-BREAKS,

National Environmental Research Center, Cincinnati, Ohio. G. R. Craun.

Journal Water Pollution Control Federation, Vol 45, No 6, p 1265-1277, June 1973, 126 ref.

Descriptors: "Water pollution effects, "Potable water, "Human diseases, "Reviews, "Bibliographies, Epidemiology, Water pollution, Salmonella, Wells, Lakes, Springs, Coliforms, Algae, Pollutant identification, Clams, Septic tanks, Vegetable crops, Path of pollutants, Turtles, Public health, Water supply, Snails, Crustaceans, Shrimp, Lead, Toxicity, Sulfattes, Viruses, Rivers, Trematodes, Animal parasites, Protozoa, Dinoflagellates. Identifiers: Salmonella typhi, Shigella sonnei, Providencia, Phages, Fecal coliforms, Infectious hepatitis, Salmonella paratyphi, Fecal pollution, Salmonella paratyphoid, Vibrio cholerae, Bulinus runcatus, Biomphalaria pfeifferi, Bulinus africanus, Bulinus nasutus, Schistosoma mansoni,

salmonella paratyphoid, Vibrio cholerae, Bulinus truncatus, Biomphalaria pfeifferi, Bulinus africanus, Bulinus nasutus, Schistosoma mansoni, Schistosoma haematobium, Schistosoma japonicum, Schistosoma boris, Leptospira pomona, Leptospira canicola, Leptospira autumnalis, Leptospira icterohaemorrhagiae, Balantidium coli, Polioviruses, Cyclops, Naegleria fowleri, Naegleria gruberi, Acanthamoeba castellanii, Acanthamoeba polyphoga, Vibrio parahaemolyticus, Gonyaulax.

Brief accounts are presented of illnesses resulting from waterborne pathogens as described in the 1972 literature. (Little-Battelle) W73-1426.

AQUATIC SEDIMENTS.

Massachusetts Univ., Amherst. W. C. Ku, and G. W. Foess. Journal Water Pollution Control Federation, Vol 45, No 6, p 1301-1310, June 1973. 82 ref.

Descriptors: \*Reviews, \*Aquatic soils, \*Bottom sediments, \*Analytical techniques, \*Cycling nutrients, \*Sinks, \*Bibliographies, Methodology, Bottom sampling, Water pollution sources, Heavy metals, Chemical analysis, Pesticide kinetics, Degradation (Decomposition), Path of pollutants, Sediment transport, Separation techniques, Alkali metals, Alkaline earth metals, Pollutant identification, Eutrophication, Lake sediments, Phosphates, Sediment-water interfaces, Nitrogen cycle, Adsorption, Manganese, Absorption, Mercury, Sorption, Lead, Nitrilotriacetic acid, Salmonella, Coliforms, Mud-water interfaces, Water quality, Cores, Core drilling, Oxidation-reduction potential, Soil properties, Pesticide residues, DDT, Radioisotopes, Zinc radioisotopes, Protozoa, Benthic fauna, Nitrogen fixation, Oxygen sag, Tracers, Annelids, Water pollution effects, Phosphorus, Dissolved oxygen, Clay minerals, Solvent extractions, Carbon, Calcium, Magnesium, Potassium, Aluminum, Iron, Copper, Nickel, Cobalt, Molybdenum, Tritium, Bacteria, Organic matter, Microorganisms.

Identifiers: Nutrient interchange, Mobilization, Chemical composition, Fate of pollutants, Phosphorus cycle, Mercury cycle, Pollutant removal, Ekman sampler, Fecal coliforms, Flameless atomic fluorescence, Gel filtration chromatography, Organic carbon, Organic nitrogen, Cr-51, Zn-65, Chromium radioisotopes, Nereis diversicolor, Polychaetes, Adsorbents, Mercuric chloride, Methylmercuric chloride, Ammonium, Vanadium, Solubilization, Heterotrophic bacteria, Marine sediments, Phosphatase, Enzyme activity, Mineralization.

A literature review covers the role of aquatic sediments in relation to water quality, nutrient cycling and interchange, and pollutant kinetics. Included also are (1) methods for sampling and analyzing such sediments, and (2) chemical characteristics and biological aspects of aquatic sediments. (Holoman-Battelle) W73-14265.

MARINE AND ESTUARINE POLLUTION, California State Univ., Long Beach. Dept. of Biology. For primary bibliographic entry see Field 05B. W73-14266

HEAVY METALS: A REVIEW OF LEAD, Illinois Univ., Urbana. For primary bibliographic entry see Field 05B. W73-14267

THERMAL EFFECTS,
Oak Ridge National Lab., Tenn.
C. C. Coutant, and H. A. Pfuderer.
Journal Water Pollution Control Federation, Vol
45, No 6, p 1331-1369, June 1973. 428 ref.

Descriptors: \*Water pollution effects, \*Water temperature, \*Thermal pollution, \*Aquatic life, \*Reviews, \*Bibliographies, Heat resistance, Heated water, Thermal stress, Laboratory lests, Bioassay, Powerplants, Effluents, Animal physiology, Aquatic populations, Aquatic productivity, Plant physiology, Animal morphology, Plant morphology, Ecological distribution, Thermal powerplants, Cooling towers.
Identifiers: Species diversity, Cleidodiscus nematocirrus, Ichthyophthirius multifiliis, Diclidophora merlangi, Chondrococcus columnaris, Cod (Fish), Gadus morhua, Vibrio anguilarum, Common sucker, Catostomus commersonii, Bleak, Alburnus alborella, Branchiomyces, Squid, Todarodes pacificus, Food conversion, Mackerels, Oncorhynchus kisutch, Enzyme activity, Salmo trutta, Animal tissues, Brown bull-head, Ictalurus nebulosus.

A thorough literature review is given of the effects of water temperature and/or thermal pollution on aquatic life. (Holoman-Battelle) W73-14768

EUTROPHICATION.

New York State Dept. of Environmental Conservation, Stony Brook.
J. Foehrenbach.
Journal Water Pollution Control Federation, Vol

45, No 6, p 1237-1244, June 1973. 60 ref.

Descriptors: \*Eutrophication, \*Nutrient removal, Water pollution sources, \*Nutrients, \*Nitrogen compounds, \*Reviews, \*Bibliographies, Water pollution control, \*Phosphorus compounds, Trophic level, Algae, Path of pollutants, Sinks, Methodology, Waste water (Pollution), Ion exchange, Volatility, Nitrification, Nitrogen, penitrification, Nitrogen fixation, Ammonia, Waste disposal, Soil disposal fields, Phosphorus compounds, Nostoc, Nitrogen fixing bacteria, Bottom sediments, Phytoplankton, Anabaena, Absorption, Phosphates, Agricultural runoff, Chelation, Groundwater, Aquatic algae, Cyanophyta, Organic acids, Growth rates, Cycling nutrients, Euphotic zone, Odor-producing algae, Nuisance algae, Mass spectrometry, Chlorophyll, Aquatic productivity, Microbial degradation, Diatoms, Chrysophyta, Plant viruses, Decomposing organic matter, Vitamins, Waste storage, Biochemical oxygen demand, Degradation (Decomposition), Soil drainage, Surface runoff, Temperature.

D \* Stille tu Sm

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Effects of Pollution—Group 5C

Nodularia, Eel grass, Zostera marina, Spartina, Bioaccumulation, Species diversity, Recovery, Bacillus cereus, Dissolved organic phosphorus, Biddulphia aurita, Organic phosphorus, Phycoviruses, Organic nitrogen, Biotin, Thiamine, Vitamin B12, Air stripping, Myriophyllum exalbescens, Surface loading, Corbicula fluminia.

The eutrophication process is reviewed from the literature in terms of sources, control, ecological factors, and nutrient removal. (Holoman-Battelle)

#### FRESHWATER MACROINVERTEBRATES,

National Field Investigations Center, Denver,

R. W. Warner. Journal Water Pollution Control Federation, Vol 45, No 6, p 1231-1237, June 1973. 69 ref.

Descriptors: Aquatic animals, \*Secondary produc-Descriptors: Aquate animas, Secondary productivity, Biological communities, Water pollution effects, "Reviews, "Bibliographies, Ecological distribution, "Biorythms, Environmental effects, Aquatic drift, Aquatic habitats, Growth stages, Niche, Waste water (Pollution), Biomass, Animal metabolism, Animal growth, Animal physiology, metaooism, Animal growth, Animal physiology, Predation, Spatial distribution, Temporal distribu-tion, Sampling, Methodology, Equipment, \*Inver-tebrates, Inorganic compounds, Organic com-pounds, \*Organic wastes, Chemical wastes, Polychlorinated biphenyls, Chlorinated hydrocar-bon pesticides, \*Pesticide toxicity, \*Radiation, DDT, DDD.

Identifiers: Macroinvertebrates, Data interpreta-Identifiers: Macroinvertebrates, Data interpreta-tion, Bioaccumulation, Species diversity, Sur-vival, Substrate utilization, Ostracods, Chla-mydotheca arcuata, Median tolerance limit, Chironomus tetans, Daphnia magna, Cs-137, Sr-85, Zn-65, Fe-59, Co-57, Mn-54, Aedes aegypti, Cesium radioisotopes, Iron radioisotopes, Man-ganese radioisotopes, Dursban, Zectran, Hydrocarbons, Immobilization, Gammarus pseu-dolimnaeus, Chloramines.

This literature review stresses the effects on freshwater macroinvertebrates of various kinds of pol-lutants: inorganic wastes, organic wastes, pesticides, and radiation. Analyses of biotic communities, secondary productivity, periodicity and drift, distribution and habital requirements, sampling techniques, and the effects of altering the physical environment are also reviewed. (Holoman-Battelle) W73-14270

RETENTION OF MERCURY WHEN FREEZE-DRYING BIOLOGICAL MATERIALS,

National Bureau of Standards, Washington, D.C. Analytical Chemistry Div. For primary bibliographic entry see Field 05A. W73-14272

BIOLOGICAL EFFECTS OF COOLING TOWER

National Environmental Research Center, Corval-

In: Water-1972, AIChE Symposium Series No 129, Vol 69, p 284-292, 1973. 5 fig, 9 tab, 6 ref.

Descriptors: Toxicity, \*Rainbow trout, \*Bioassay, \*Cooling towers, Chromates, Zinc, Phosphates, Sulfates, Sodium, Ammonia, Boron, Water pollution effects, Chlorophyta, Heavy metals. Identifiers: \*Blowdown, Selenastrum capricornu-

tum, Morpholine, Cyclohexylamine, Hydrazine, Salmo gairdneri, Standard methods, Sodium chro-mate, Zinc phosphate.

Toxicity was determined of a 'typical' cooling tower blowdown and of its individual components. Since blowdown composition is variable, a simulated blowdown was made using chemicals and

concentrations listed in waste discharge permit ap-plications. The mixture contained varying amounts of chromate, zinc, phosphate, sulfate, boron, sodi-um, ammonia, morpholine, cyclohexylamine, and hydrazine and simulated blowdown from the Trojan Nuclear Plant. Separate tests were also conducted with sodium chromate, zinc phosphate, and with Hondown without chromate. Eish (Saland with blowdown without chromate. Fish (Salmo gairdneri) and an alga (Selenastrum capricor-nutum) were used in bioassays of the mixtures. nutum) were used in bioassays of the mixtures.
Algal assays were conducted according to the 'Algal Assay Procedure, Bottle Test'. Fish bioassays were conducted in accordance with procedures given in 'Standard Methods'. Algal growth was reduced by blowdown at full strenth and at dilutions of 0.1. Fish were killed at dilutions of 0.1; no offset were characted in 0.024 division. The Confection of the control of 0.024 division. The Confection of 0.024 division. effect was observed at 0.032 dilution. The LC50 value was 0.068 dilution. With sodium chromate, algal growth was reduced at 0.139 ppm, and fish survived 96 hours at 31 ppm. Zinc phosphate had no significant effect on algal growth at 0.016ppm. The LC50 for fish was 0.09 ppm zinc phosphate. Based on all the tests, zinc and chromium were identified as the toxic components in the blowdown. It is noted that synergistic effects may occur in other mixtures containing different com-pounds. Furthermore, the organisms used in the bioassays must be specified since toxicities may differ for different ones. (Little-Battelle) W73-14285

PHYSICO-CHEMICAL ASPECTS OF LAKE MCILWAINE (RHODESIA), A EUTROPHIC TROPICAL IMPOUNDMENT, Rhodesia Univ., Salisbury. Div. of Biological

B. E. Marshall, and A. C. Falconer. Hydrobiologia, Vol 42, No 1, p 45-62, July 6, 1973. 9 fig, 1 tab, 35 ref.

Descriptors: \*Physiochemical properties, \*Impoundments, \*Eutrophication, Hydrology, \*Water quality, Water level fluctuations, Thermal stratification, Water chemistry, Tropical regions, Hydrologic budget, Water temperature, Dissolved oxygen, Nitrates, Ammonia, Hydrogen ion concentration, Conductivity, Nitrites, Chemical analysis, Water analysis, Phosphates, Alkalinity, Hardness (Water), Iron, Manganese, Heavy metals, Hypolimnion, Trophic level, Epilimnion, Water pollution, Pollutant identification. Identifiers: Seasonal variation, Orthophosphates, \*Rhodesia (Lake McIlwaine).

Lake McIlwaine is a tropical eutrophic impound-ment in Rhodesia. The normal oxygen and temperature patterns are described, and the effect of flood water on these patterns is discussed. Several important chemical parameters are described, and the effects of lake-level fluctuations and stratification are outlined. There is a brief discussion on the effects of cutrophication in tropical lakes, and some indication is given of measures being taken to reduce nutrient input to Lake McIlwaine. (Holoman-Battelle) W73-14291

EFFECTS OF REDUCED OXYGEN CONCEN-TRATIONS ON NORTHERN PIKE (ESOX LU-CIUS) EMBRYOS AND LARVAE,

National Water Quality Lab., Duluth, Minn. R. E. Siefert, W. A. Spoor, and R. F. Syrett. Journal of the Fisheries Research Board of Canada, Vol 30, No 6, p 849-852, June 1973. 2 fig, 1 tab, 16 ref.

Descriptors: \*Bioassay, \*Reproduction, \*Dissolved oxygen, Water temperature, Flow rates, \*Pikes, Larvae, \*Embryonic growth stage, Water pollution effects, Limiting factors, Mortality, Hatching. Identifiers: Survival. Esox lucius.

The objective was to determine the effects of continuous dissolved oxygen concentrations in the range 50-12.5 percent saturation on the survival and development of northern pike (Esox lucius) embryos and larvae from egg fertilization until all embryos and larvae from egg fertilization until all surviving larvae fed. Eggs were mixed with milt for fertilization and placed in acrylic plastic experimental chambers containing three compartments, one compartment where the water and gas mixture entered, one containing the embryos, and one containing larvae. Tests were conducted at combinations of temperatures, flow rate, and oxygen concentration. At 15 and 19C, and at flows of 60 and 30 ml/min (velocities about 3.3 and 1.6 cm/min), 50 percent oxygen saturation was sufficient for survival and development of norther cient for survival and development of northern pike from fertilization until all surviving larvae fed. Oxygen tensions of about 33 percent saturation appeared inadequate for proper survival. (Lit-tle-Battelle) W73-14306

CADMIUM UPTAKE BY FIDDLER CRABS EX-POSED TO TEMPERATURE AND SALINITY

South Carolina Univ., Columbia. Belle W. Baruch Coastal Research Inst.

Journal of the Fisheries Research Board of Canada, Vol 30, No 6, p 846-848, June 1973. 1 tab,

Descriptors: \*Bioassay, \*Cadmium, \*Salinity, \*Water temperature, Heavy metals, Radioactivity techniques, \*Crabs, Absorption, \*Thermal stress, techniques, \*C Salt tolerance.

San tolerance.

Identifiers: Fiddler crabs, \*Bioaccumulation, Biological samples, Macroinvertebrates, Uca pugilator, Sample preparation, Scintillation counting, Gills, Hepatopancreas.

Fiddler crabs (Uca pugilator) were collected from an unpolluted estuary near Georgetown, South Carolina and, after acclimation, subjected to 1 microcurie of Cd-109 and 10 ppm Cd (2 plus) as cadmium chloride in filtered seawater at tempera-ture and salinity combinations of 33, 25, and 10C and 3.0 and 1.0 percent salinity. After 24, 48, and 72 hr, samples were sacrificed and the gill and hepatopancreas weighed and digested for 24 hr. Scintillation fluid was added to the digested sample and Cd determined by scintillation counting. At each temperature crabs accumulated more Cd in low salinity water than in high salinity water. This effect is probably due to osmotic stress caused by the different salt concentrations. Maximum accumulations occurred at high temperature and low salinity with totals for gill and hepatopancreas of 4.98 micrograms at 24 hr, 10.10 micrograms at 48 hr, and 17.44 micrograms at 72 hr. (Little-Battelle) W73-14307

MOLYBDENUM CONCENTRATIONS IN TIS-SUES OF RAINBOW TROUT (SALMO GAIRD-NERI) AND KOKANEE SALMON (ONCOR-HYNCHUS NERKA) FROM WATERS DIFFER-ING WIDELY IN MOLYBDENUM CONTENT, Colored Light, Boulder, Dont of Equipmental Colorado Univ., Boulder, Dept. of Environmental, Population, and Organismic Biology. For primary bibliographic entry see Field 05B. W73-14309

SUMMER ALGAL COMMUNITIES AND PRI-MARY PRODUCTIVITY IN FISH PONDS, Alabama Agricultural Experiment Station, Auburn. C. E. Boyd.

Hydrobiologia, Vol 41, No 3, p 357-390, May 15, 1973. 10 fig, 6 tab, 61 ref.

Descriptors: \*Primary productivity, Biological communities, \*Aquatic algae, \*Phosphorus, \*Nitrogen, Water pollution effects, Ecology, Phytoplankton, Eutrophication, \*Cyanophyta, Fertilization, Nutrients, Standing crops, Chrysophyta, Chlorophyta, Euglenophyta, Pyr-

#### Group 5C-Effects of Pollution

rophyta, Systematics, Dominant organisms, Protozoa, Ecological distribution, Photosynthesis, Turbidity, Water chemistry, Ammonia, Hardness (Water), Nitrates, Alkalinity, Phosphates, Respiration, Chlorella, Chlamydomonas, Euglena, Diatoms, Cladophora, Competition, Laboratory tests, Dissolved oxygen, Water sampling. Identifiers: \*Fish ponds, Oscillatoria, Raphidiopsis curvata, Anacystis spp, Microcystis aeru-ginosa, Coelosphaerium, Anabaena circinalis, Ictalurus punctatus, Chlorophyll a, Coelastrum tanurus punctatus, Chiorophyli a, Coelastium microporum, Desmids, Dictyosphaerium, Scenedesmus spp, Flagellates, Gloeocystis, Closterium, Crucigenia, Kircheneriella, Chlorococ-cum, Chlorogonium, Bumilleria, Tetraedron, Roya, Gomphosphaeria, Species diversity index, Spirogyra spp, Chara spp, Nitella, Rhizoclonium hieroglyphicum, Pithophora kewensis, Hydrodictyon reticulatum, Lyngbya, Oedogonium, Cosmarium tumidum, Ankistrodesmus falcatus, Sphaerocystis schroeteri, Quadrigula chodatii, Oocystis borgei, Planktosphaeria gelatinosa, Coelastrum proboscideum, Merismopedia tranquilla, Anacystis cyanea, Spirulina princeps, Nannochloris bacillaris, Schroederia ancora, Nephrocytium agardhianum, Staurastrum natator, Sphaerocystis schroeteri.

Data are presented on primary productivity and phytoplankton communities in new experimental ponds which received the following treatments; ammonium nitrate and triplesuperphosphate, triplesuperphosphate, cracked corn (10 percent crude protein) and Auburn No. 3 fish feed (36 percent crude protein). Comparative data on algal communities were also obtained from production ponds which received feeds or fertilizers. Basic ecological data on macro-algae are also presented. All nutrient additions to experimental ponds resulted in higher levels of gross photosynthesis and greater concentrations of chlorophyll a than were found in the control treatments. Fertilization with both nitrogen and phosphorus gave the highest values. Chlorophyll a and gross photosynthesis were higher in ponds receiving high protein content feed (Auburn No. 3) than in ponds to which low protein content feed (corn) was applied. Persistent blooms of blue-green algae occurred in ponds receiving nitrogen and phosphorus fertilization. Phosphorus only fer-tilization produced blooms of blue-greens, but these blooms did not persist as in the ponds to which nitrogen was also added. Control ponds were dominated by green algae. Blue-green algae were seldom abundant in feed treatments. Production ponds had high level of gross photosynthesis and large concentrations of chlorophyll a. Many of the production ponds which received feed applications developed heavy blooms of blue-green algae. The major species of blue-green algae observed were Oscillatoria sp., Raphidiopsis curvata, Anacystis nidulans, A. aeruginosa, Spirulina sp., and Anabaena circinalis. Heterocyst bearing forms, which can presumably fix nitrogen, were seldom noted in ponds that received continuous additions petition of macro-algae with phytoplankton are presented. (Holoman-Battelle) W73-14315 of nitrogen from fish feeds. Macro-algae are abun-

#### ORGANICS,

Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering. For primary bibliographic entry see Field 05A.

THE METABOLISM OF LONG-CHAIN FATTY ACIDS AND ALCOHOLS BY CANDIDA TROPI-CALIS AND SACCHAROMYCES CEREVISIAE.

Antonie van Leeuwenhoek, Vol 39, No 1, p 137-149, 1973. 6 fig. 5 tab, 10 ref.

Descriptors: "Metabolism, "Yeasts, "Alcohols, Growth rates, Organic acids, Marine fungi, Organic compounds, Plant growth, Hydrogen ion concentration.

Identifiers: \*Fatty acids, Substrate utilization, Batch cultures, Heterotrophic nutrition, Candida tropicalis, Saccharomyces cerevisiae, Aliphatic hydrocarbons, Tetradecanoic acid, Fate of pollutants, n-Paraffins, Octadecanoic acid, Dodeca acid, Gas oil, Continuous cultures, Pristane, Un-decanoic acid, Tridecanoic acid, 1-Dodecanol, 1-Tetradecanol, 1-Hexadecanol, 1-Octadecanole acid, Nonadecanoic acid, Nonadecanoic acid, 1-Eiscosanol.

The factors affecting the growth of Candida tropicalis and Saccharomyces cerevisiae on medium-and long-chain fatty acids and alcohols in batch culture were investigated. Growth on solid acids and alcohols dispersed in the medium is a max-imum for tetradecanoic acid and tetradecanol. The poorer growth observed on shorter chain lengths can be ascribed to their toxicity to the yeasts, while the fall off in growth on the higher members is explained by their increasing insolubility in the medium. When the longer-chain-length acids are dissolved in a non-metabolizable hydrocarbon, the growth of C. tropicalis is improved, but that of S. cerevisiae is unaffected. This suggests that acids can enter the cells of the former organisms by direct contant with the hydrocarbon droplets. The surface of S. cerevisiae is too hydrophilic for this transfer mechanism to be possible. Fatty acids dissolved in gas oil are utilized as substrates for the growth of Candida tropicalis in competition with the n-paraffins contained in the gas oil. Each fatty acid contributes to a constant proportion of yeast produced, but this proportion decreases as the chain is lengthened. Thus, in mixtures of gas oil with dodecanoic acid, 65 percent of the yeast is with dodecanoic scial, 65 percent of the yeast is produced from metabolism of the acid, while with octadecanoic acid only 15 percent is produced. The log specific rates of utilization of the fatty acids within this range diminish linearly with increasing chain length. (Holoman-Battelle) W73-14325

#### ECOLOGICAL EVALUATION OF MULTIUSE WATERS RECEIVING PRIMARY TREATMENT EFFLUENT PRIOR TO A MAJOR FLOW IN-CREASE.

Connecticut Univ., Storrs. Inst. of Water

Available from the National Technical Information Service as PB-223 502, \$2.75 in paper copy, \$1.45 in microfiche. Completion Report, 1973. 6 p, 1 fig, 1 tab, 5 ref. OWRR A-037-CONN (2). 14-31-0001-3207.

Descriptors: \*Estuaries, \*Sewage effluents, Pollu-tants, \*Phytoplankton, Nitrates, Phosphates, Biochemical oxygen demand, Coliforms, \*Con-necticut, Invertebrates, Streptococcus, Monitoring, Sampling, Dissolved oxygen.
Identifiers: Fecal streptococci, Benthic inver-

tebrates, \*Mumford Cove (Conn)

A chemical and biological study is described for a Connecticut estuary receiving 0.25-0.50 MGD of treated sewage effluent prior to construction of a secondary treatment plant with a projected flow of 5-6 MGD. An adjacent, unpolluted cove was used as a control. Three stations in each estuary were sampled bi-weekly from September 1970 to June 1972. Analyses included temperature, salinity, dissolved oxygen, B.O.D., Nitrate, and phosphate. Counts were made of total bacteria, total and fecal coliforms, fecal streptococci, phytoplankton, and benthic invertebrates. Results indicated that nitrate, phosphate, and D.O. levels at the current outfall area at the head of the receiving cove are high enough to suggest that the increased flow of fresh water and nutrients into the saline cove may produce adverse effects in terms of stimulating the growth of existing populations of flagellated phytoplankters. While only the effluent mixing area is affected at present, the greatly increased effluent volume projected for the cove will influence a larger area as a function of wind, tides, and other factors. The directive by the State of Connecticut Department of Environmental Protection to extend the new outfall area approximately one mile seaward into Fishers Island Sound is considered prudent. W73-14361

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PHOTOSYNTHESIS, ABUNDANCE, AND CHEMISTRY OF LAKE WATER AT FAIRMONT, MINNESOTA, Minnesota Univ., St. Paul. Dept. of Ecology and

Behavioral Biology. A. S. Knoll, and R. O. Megard.

A.S. Kholi, and K. O. Megard. Available from the National Technical Informa-tion Service as PB-223 428, \$4.50 in paper copy, \$1.45 in microfiche. University of Minnesota Lim-nological Research Center, Minneapolis, July 1973. 46 p., 17 fig, 7 tab, 8 ref. OWRR A-026-MINN (1).

Descriptors: \*Eutrophication, \*Algae, \*Nutrients, Lakes, \*Minnesota, Plankton, Phosphorus, Nitrogen, \*Chlorophyll, \*Photosynthesis, Nitrates, Water pollution effects. Identifiers: Fairmont (Minn), Ammonia-nitrogen, Nitrate-nitrogen.

Concentrations of phosphorus, nitrate, ammonia oxygen, chlorophyll a, and rates of algal photosynthesis in 5 lakes in Fairmont, Minnesota, were measured during spring, summer, and autumn, 1972. The relative abundance of the planktonic algae in the lakes was assessed by measuring tonic aigae in the lakes was assessed by measuring the concentrations of chlorophyll a, one of the green pigments in algae and other plants. Average concentrations of chlorophyll a ranged from 43 mg/m3 in Budd Lake to 74 mg/m3 in Amber Lake. The average concentration for all five lakes, 57 mg/m3 is about twice the average concentration. mg/m3, is about twice the average concentration in Lake Minnetonka, near Minneapolis, and also about twice the highest concentrations in Lake Erie, the most polluted of the Great Lakes. Concentrations of dissolved phosphorus, nitrate-nitrogen, and ammonia-nitrogen were also very high. Substantial reductions of nutrient concentrations will be required to achieve significant reduc-tions of algae in the Fairmont Lakes. It would be desirable to reduce the influx of both nitrogen and phosphorus, but phosphorus is easier to control, because many of the nuisance algal are able to fix nitrogen if there is sufficient phosphorus in the W73-14364

EFFECT OF SILT AND SILT REMOVAL IN A

PRAIRIE LAKE,
Dakota State Coll., Madison, S. Dak. Dept. Biology; and Dakota State Coll., Madison, S. Dak.

Dept. of Chemistry.
C. L. Churchill, C. K. Brashier, and G. Leidahl. COP, 94 fig, 6 tab, 15 ref. EPA Project 16010 DZK.

Descriptors: Water pollution sources, \*Sediments, \*Nutrients, \*Eutrophication, Lakes, Aquatic soils, Minerals, Water properties, \*South Dakota, \*Silts, Silting, Lake sediments, Water pollution effects, Monitoring. Identifiers: \*Gabion silt traps, Lake Herman (S. Dak), Prairie lakes, Lake Madison (S. Dak).

A surveillance program has been maintained on two shallow, warm water prairie lakes and their tributaries. One of these lakes, Lake Madison, is domestically polluted with the effluent from the sewage treatment plant of Madison, South Dakota. The other, Lake Herman, is polluted due to siltation caused by run-off from a large, intensively farmed watershed. This surveillance program has resulted in comparisons of chemical nutrients and biota of a heavily silted lake with those of a relatively unsilted, but domestically polluted lake. The surveillance program on the Lake Herman tributaries has also led to conclusions regarding nutrient levels in successive spring run-offs. During the summers of 1969 and 1970 a total of seventeen aphion-type silt traps were constructed across the gabion-type silt traps were constructed across the major feeder streams on the Lake Herman watershed in order to retard lake siltation. The traps were of several structural types and were constructed in locations with different types of creekbeds and different water-flow rates in order to evaluate which combinations of design and location were most effective. The traps were successful as filters for large debris but had limited success as silt-retaining devices. However, ero-sion occurred around or under many of the traps thus diminishing their effectiveness. (EPA)

THE DISINFECTION OF SEWAGE BY CHLOROBROMINATION,
Dow Chemical Co., Midland, Mich. Hologens Research Lab For primary bibliographic entry see Field 05D.

BIOLOGICAL EFFECTS OF FENITROTHION IN THE DIET OF BROOK TROUT, Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
D. J. Wildish, and N. A. Lister.
Available from ACS-Div. of Water, Air and Waste

Chem., Publications Manager, Mellon Inst., 4400 Fifth Ave., Pittsburgh, Pa. 15213, Price \$4.00. In: Preprints of Papers Presented at 165th National Meeting of American Chemical Society, April 8-13, 1973, Dallas, Tex: American Chemical Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 76, p 79-84, 1973.

Descriptors: \*Pesticide residues, \*Fishkill, \*Toxicity, Pesticide toxicity, Canada, Forestry, Pest control, Insecticides, \*Brook trout. Identifiers: Spruce budworm, \*Fenitrothion.

Aerial insecticide spraying to control the spruce Aerial insecticide spraying to control the spruce budworm, a defoliating insect pest which seriously reduces tree growth, was begun in 1952 with DDT, but fenitrothion, 0,0-dimethyl-0 3-methyl-4-nitrophenyl) phosphorothionate, has been used since 1968. The possibility that aquatic and terrestrial insects killed by operational spray doses of fenitrothion may cause lethal or sublethal effects directly in salmonids was shown by experiments to be unlikely. The highest level found in poisoned insects is 3.000 times less than the level at which sects is 3,000 times less than the level at which behavioral effects were noted. Reductions in insects following spraying may be of sufficient magnitude and persistence to significantly reduce ra-tion and hence reduce salmonid production. (Knapp-USGS) W73-14398

CONCERNING THE INFLUENCE OF HERBI-CIDES ON SEVERAL FRESHWATER ANIMALS. UBER DEN EINFLUSS DER HERBI-ZIDE AUF EINIGE SUSSWASSERTIERE,

O. Pravda. Hydrobiologia, Vol 42, No 1, p 97-142, July 1973. 17 fig, 20 tab, 80 ref.

Descriptors: \*Herbicides, \*Aquatic animals, \*Bioassay, \*Pesticide toxicity, \*Water pollution effects, Invertebrates, Freshwater fish, Carbamate pesticides, Phenolic pesticides, Lethal limit, Laboratory tests. Chlorinated hydrocarbon pesticides, Frogs, Isopods, Crustaceans, Amphipoda, Waterfleas, Amphibians, Annelids, Tubificids, Gastropods, Mollusks, Carp, Phenols, Inorganic peticides, Aquatic insects, Perches, Water temIdentifiers: "Median tolerance limit, Sensitivity, Macroinvertebrates, Red-sided shiner, Phoxinus phoxinus, Planaria gonocephals, Turbellaria, Platyhelminthes, Tubifex, Lymnaea stagnalis, Pond snails, Scuds, Gammarus pulex, Daphnia pulex, Asellus aquaticus, Micronecta minutissima, Esox lucius, Northern pike, Cyprinus carpio, Leucaspith delineatus, Perca Iluvatilis, Rana temporaria, Bugs, Tadpoles, Travex, Kampinex L, Rafex, Dinoseb, Agrion, Dikotex 30, MCPA, DP-Fest, Spritz-Hormit, TCP, NaTA, Ugex. Alipur, Liro CIPC, Phenoxyacetic acid.

Toxicity of fourteen herbicides has been determined for thirteen animal species: Planaria gonocephala, Tubifex sp, Lymnaea stagnalis, Daphnia pulex, Gammarus pulex, Asellus aquaticus, Micronecta minutissima, Esox lucius, Cyprinus carpio, Phoxinus phoxinus, Leucapius delineatus, Perca fluviatilis, Rana temporaria, in 510 laboratory experiments. It was followed in three concentrations and expressed both in tables. by the value LT50 or by the various degree of damage of the organisms, and in graphs. The organisms were divided into four groups according to their sensitivity to herbicides: (1) organisms with high sensitivity; (2) sensitive; (3) medium sensitivity; (2) sensitive; (3) medium sensitivity. sitive; (4) little sensitive. From the point of view of the toxicity the herbicides were divided into three groups: (1) powerfully toxic, (2) medium toxic; (3) little toxic. A relationship between the intensity of toxicity and the chemical structure of herbicides was found. The first group includes herbicides on the basis of carbamates and phenois, the second up includes the derivatives of phenoxyacetic acid, and the third group includes inorganic herbi-cides and those pertaining to the group of the chlorated organic substances. The menchanism of the toxic action was followed from the point of view of the mutual relationship of herbicide toxicity and the sensitivity of organisms. Eight basic types of this action were found. Special attention types of this action were found. Special attention was paid to those types where significant repara-tion phases appeared during the experiments. Only inorganic herbicides and those from the group of the chlorated organic substances or eventually those on the basis of phenoxyacetic acid may be used for mass application in water economy. The used for mass application in water economy. The use of herbicides from the group of phenols and carbamates should be prohibited near water bodies. (Holoman-Battelle)

**EXAMINATION OF ULTRASTRUCTURE AND** GROWTH OF THE CELL WALL OF SPYRIDIA FILAMENTOSA (WULF.) HARV., UNTER-SUCHUNGEN UBER BAU UND WACHSTUM DER ZELLWANDE VON SPYRIDIA FILAMEN-TOSA (WULF.) HARV.), Thessaloniki Univ., Salonika (Greece). Botanical

N.I. Tsekos, and S. Haritonidis. Nova Hedwigia, Vol 23, No 4, p 785-793, 1972. 1 fig, 21 ref.

Descriptors: "Rhodophyta, "Marine algae, "Cytological studies, Plant growth, Marine plants, Electron microscopy, Plant tissues, Cellulose. Identifiers: "Ultrastructure, "Cell wall, "Spyridia filamentosa, Polarization microscopy.

The structure and the course of development in cell walls of the red alga Spyridia filamentosa (Wulf.) Harv. were analyzed by cytochemistry and polarization microscopy. (1) The cell wall is composed of two layers; the inner one consisting of cellulose, the outer of acid carbohydrates. Contrary to other Rhodophyceae analyzed hetherto, the outer layer of Spyridia filamentosa exhibits birefringence; under the polarization microscope and after staining with methylene blue it appears distinctly stratified. (2) The cell wall proper of the distinctly stratuted. (2) The cell wan proper of the youngest central cells in the thallus tip is uniform, and it encloses the whole protoplast without any gap. As it is the case with Ceramium species, adult central cells show three distinct regions: two caplike parts (each of which at the basal and spical pole of the cell) and a conic part encircling the remainder of the cell. The origin of the wall structure of adult central cells is discussed. (3) The inner layer of the cell wall is composed of lamel-lae. (4) The intensity of the cellulose reaction and of birefringence increases with the ace of the cells. In young cells it is rather poor. (5) Nearly all parts of the thallus that border directly to the surrounding water have more or less thickened external walls. (6) Beside the axial pit connections of the central cells, which show an intense light refrac-tion, there are another eighteen pits arranged in a ring at the apical pole. (Holoman-Battelle) W73-14439

ISOLATION AND PROPERTIES
RIBONUCLEASE-DEFICIENT MUTANT
SALMONELLA TYPHIMURIUM,
California Univ., Davis. Dept. of Bacteriology.
For primary bibliographic entry see Field 05A.

EFFECTS OF ARTIFICIAL DESTRATIFICA-TION ON PRIMARY PRODUCTION AND ZOOBENTHOS OF EL CAPITAN RESERVOIR, CALIFORNIA, Michigan State Univ., East Lansing, Dept. of

Fisheries and Wildlife.

A. W. Fast.

Water Resources Research, Vol 9, No 3, p 607-623, June 1973. 10 fig, 2 tab, 37 ref.

Descriptors: \*Benthic fauna, \*Primary productivi-ty, \*Destratification, \*Mixing, Sampling, Oligochaetes, Midges, Clams, Phytoplankton, Radioactivity technique, Animal populations, Tu-bificids, Mollusks, \*California.

Identifiers: Sorting, Sugar flotation, Macroinvertebrates, Limnodrilus hoffmeisteri, Bathrioneurum vejdovskyanum, Evilyodrilus bavaricus, Evil'indiversayanum, Eviporinis davancies, Evi-lyodrilus hammoniensis, Tubifex tubifex, Chironomus attenuatus, Procladius bellus, Procladius denticulatus, Tanytarsus spp, Corbicu-la manilensis, Asiatic clam, \*El Capitan Reservoir

El Capitan reservoir was artificially mixed using compressed air during the summers of 1965 and 1966 to investigate the effects of destratification on primary production and zoobenthos. Phytoplankton production was measured by the C-14 technique. Zoobenthos was sampled with an unscreened Ekman dredge, screened with a no. 30 sieve, and sorted by sugar flotation. Estimates of organisms not sorted by sugar flotation were made by subsampling sediments. Physical and chemical characteristics of the water were also determined. The zoobenthos was numerically dominated by oligochaete worms (Limnodrilus hoffmeisteri, Bathrioneurum vejdovskyanum, Evilyodrilus bavaricus, E. hammoniensis, and Tubifex tubifex) and chironomid larvae (Chironomus attenuatus, Procladius bellus, P. denticulataus, and Tanytar-sus spp.). The Asiatic clam (Corbicula manilensis) became well established during the study period. The results show that mixing and reservoir volume increases resulted in more uniform physical and chemical conditions, aerobic conditions throughout the lake, increased primary production, increased depth distributions of zoobenthos, and zoobenthos population increases. Increased primary production was related to a decrease in algal depth distribution. This decrease was caused by incomplete destratification, since thermal microstratification persisted near the lake surface. Zoobenthos were distributed throughout the lake during mixing, whereas they were confined to shallow depths during well-stratified times. Water volumes increased three-fold during the study and greatly confounded interpretation of the mixing effects. (Little-Battelle) W73-14444

#### Group 5C-Effects of Pollution

DETRITUS IN LAKE TAHOE: STRUCTURAL MODIFICATION BY

California Univ., Davis. Inst. of Ecology.

preparation, Aggregation

H. W. Paerl. Science, Vol 180, No 4085, p 496-498, May 4, 1973.

\*Detritus, \*Microorganisms, Descriptors: Petitius, Microganisms, Silodegradation, Organic mater, Nutrients, Electron microscopy, Bioassay, Periphyton, Metabolism, "California.
Identifiers: \*Lake Tahoe, Ward Creek, Sample

Water samples were collected from Lake Tahoe over a vertical profile of 0 to 440 m to investigate microbiological utilization of detritus. Subsamples were filtered through Metricel filters, fixed with glutaraldehye, dehydrated by stepwise immersion in increasing concentrations of ethyl alcohol, portions mounted and gold plated, and viewed by scanning electron microscopy (SEM). Subsamples were also monitored for microbial heterotrophic activity as a measure of mineralization rates by determining acetate uptake. Total particulate cardetermining acetate uptake. Total particulate car-bon, and acetate concentrations were determined in samples taken from all depths. In a separate stu-dy, detritus was collected from Ward Creek, a tributary of Lake Tahoe, homogenized, sterilized, and divided into dialysis bags which were impervious to detritus and microorganisms, but allowed passage of nutrients and metabolic waste products. Two sets of dialysis bags were used: one containing sterile detritus and one containing lake containing steril eduration and one containing take water and live microorganisms. Both sets were incubated in Lake Tahoe and periodically examined by light microorgopy and SEM. The results show that readily identifiable groups of microorganisms present on nonliving particulate organic matter (detritus) in the upper waters of Lake Tahoe are attached in specific ways and appear responsible for detrital aggregation. This microflora is associated with active heterotrophic metabolism, but deeper waters possess little detrital microflora and little heterotrophic activity. (Little-Battelle) W73-14445

MICROORGANISMS: IN SITU RESPONSE TO NUTRIENT ENRICHMENT, Woods Hole Oceanographic Institution, Mass. H. W. Jannasch, and C. O. Wirsen. Science, Vol 180, No 4086, p 641-643, May 1973. 1 fig, 2 tab, 12 ref.

Descriptors: \*On-site tests, \*Deep water, \*Sea water, \*Marine microorganisms, \*Microbial degradation, \*Organic matter, \*Nutrients, Organic compounds, Methodology, On-site data collections, Radioactivity techniques, Spectrophotometry, Incubation, Carbohydrates. Identifiers: \*Enrichment, \*Substrate, Utilization, Degradation products, Biotransformation, Paper, Ulva, Balsa wood, Beech wood, Casamino acids, Sodium acetate, Mannitol, Sodium glutamate, Liquid scintiallation, Chemical recovery, Starch, Agars, Gelatin, Fate of pollutants.

Since microbial conversion of organic substrates was rather retarded when lab cultures and mixed populations of surface-born marine bacteria were incubated in the deep sea, it was assumed that incupated in the deep sea, it was assumed that microflora indigenous to the deep water or sediment would respond differently. To check this possibility, a housing for sterilized sample bottles was devised that permitted inoculation directly on the deep-sea floor. A rack holding 20 120-ml bottles was enclosed in a pressure-tight aluminum cylinder. As in earlier experiments, the bottles ontained the media in concentrated form in quantities of 1 to 10 ml and were equipped with punc-tured serum caps for self-inoculation. This sample-housing vessel was attached to the research submarine Alvin. The samples were incubated at 1830 m depth and 4 C. The bottles filled at the incubation site contained 0.1 percent starch, 0.033 per-

cent agar or 0.1 percent gelatin. After retrieval and poisoning with HgC12, starch, agar, and gelatin concentrations were determined. Sterile samples concentrations were determined. Sterile samples of bond paper, paper towels, balsa wood, beech wood, and Ulva thalli were incubated in separate bottles for 51 wk and their decomposition determined. 30, 10, 5 and 2 micrograms/ml of isotopically-labeled mannitol, sodium acetate, sodium glutamate, and casamino acids were also deposited for 14 wk and the degree of substrate conversion into cell material and CO2 was measured. Total recovery of labeled material averaged 97 necessary. recovery of labeled material averaged 97 percent. After inoculation of sterile organic materials on the deep-sea floor and in situ incubation for 1 year, relatively minute rates of microbial transformation were recorded. This extremely slow conversion rate, as well as the type and quantity of organic matter normally reaching the ocean floor, appear to characterize microbial life in the deep sea. (Holoman-Battelle)

CHLORINE AND TEMPERATURE STRESS ON

ESTUARINE INVERTEBRATES, Academy of Natural Sciences of Philadelphia, Benedict, Md. Benedict Estuarine Lab.

Journal Water Pollution Control Federation, Vol 45, No 5, p 837-841, May 1973. 2 fig. 1 tab, 11 ref.

Descriptors: \*Thermal stress, \*Chlorine, Water pollution effects, \*Laboratory tests, \*Estuaries, \*Chlorination, Animal populations, Crustaceans, Model studies, Water pollution, Copepods, Shrimp, Amphipoda, Mortality, Water temperature, Cooling water, "Invertebrates, Larvae, Heat resistance, "Thermal pollution, Bioassay, Marine

Identifiers: Macroinvertebrates, Synergistic effects, Chemical concentration, Barnacles, Nauplii, Gammarus, Beach fleas, Melita nitida, Palaemonetes pugio, Chlorine residual, Grass shrimp.

Five species of estuarine invertebrates subject to entrainment in the cooling water system of a steam electric station were exposed experimentally to chlorine and temperature stresses simulating plant operations. Estuarine water was injected with chlorine gas to achieve a final concentration of 2.5 mg/l total chlorine residual. This concentration effected as high as 80 percent population mortality in the barnacle nauplii Balanus sp and 90 percent in the copepod Acartia tonsa during a 5-min exposure. Temperature elevations of 10 F (5.5 C) and 20 F (11 C) for 3 hr had no significant effect on population mortality. Two amphipods, Gammarus sp and Melita nitida, and one species of shrimp, Palaemonetes pugio, exhibited greater tolerance to the same stress conditions. (Holoman-Battelle)

ABOLITION OF SWARMING OF PROTEUS BY P-NITROPHENYL GLYCERIN: APPLICATION TO BLOOD AGAR MEDIA,

Iowa State Univ., Ames. Dept. of Bacteriology. For primary bibliographic entry see Field 05A. W73-14456

PLANT PHENOLS AND RELATED ORGANIC COMPOUNDS IN PUBLIC WATER SOURCES, THEIR RELATIONSHIP TO CHLORINATION, Rhode Island Univ., Kingston. Dept. of Pharacology.

For primary bibliographic entry see Field 05B.

INTERCEPTION AND DEGRADATION OF PESTICIDES BY AQUATIC ALGAE, Rhode Island Univ., Kingston. Dept. of Phar-

Available from the National Technical Informastroin Service as PB-223 506, \$2.75 in paper copy, \$1.45 in microfiche. OWRR A-044-RI (1). 14-31-0001-3840.

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Descriptors: \*Pesticide residues, \*Degradation (Decomposition), \*Algae, \*Cyanophyta, Water pollution effects.

Identifiers: \*Pesticide degradation, Synechococcus elongatus.

A method to quantitate the components of a twocomponent system which were unresolvable in a given gas chromatography system was developed. The method utilized the p-values of individual components. Blue-green algae from two streams in Rhode Island were examined for pesticide residue levels. In one case the levels of p.p.-DDT were 15-44 ppb dry weight of algae; the other was 1.8-18 ppb. Experiments indicated that Synechococcus elongatus accumulated within 24 hours virtually all eiongatus accumulated within 24 nours virtually all of the p,p'-DDT added to the media. About 4% was metabolized to p,p'DDE which was found on the cell wall, none being detected within the cells. At a level of 0.99 ppm, the p,p'-DDT was not toxic

WATER QUALITY AND CONSUMER COSTS. Orange County Water District, Santa Ana, Calif. For primary bibliographic entry see Field 06C. W73-14536

CANADARAGO LAKE EUTROPHICATION: PHOSPHORUS ALONG A SECTION OF OCQUIONIS CREEK, New York State Dept. of Environmental Conser-

vation, Albany. Environmental Quality Research and Development Unit. R. J. Mumford.

Technical Paper Number 21, October, 1972. 87 p, 11 fig, 3 tab, 27 ref, 1 appendix.

Descriptors: \*Eutrophication, \*Phosphorus, \*Data collections, \*Water pollution sources, Phosphates, Fertilizers, Outfall sewers, New York, Waste identification, Pollutant identification, Streams.
Identifiers: \*Canadarago Lake (New York).

In order to better understand the problems of eutrophication, a detailed demonstration study of Canadarago Lake is being performed by the New York State Department of Environmental Conser-vation. This lake is an eutrophic hard-water lake vation. This late is an entirphic native water take location in Otsego County, and has four major in-lets. The phosphorus levels in a 5.8 mile section of Ocquionis Creek are documented. Phosphorus levels were studied because of their known contribution to the problem of eutrophication. It was desired to know how phosphorus levels changed along the length of the Creek to determine the sources of the phosphorus. Samples were taken above and below possible point sources, at changes in land use, near tributaries, etc. Samples were taken at periods of low flow and analyzed for particulate, soluble, and total phosphorus. No large phosphorus levels were found from agricultural lands, possibly due to the lack of surface ru-noff. Point sources (open sewers) changed the phosphorus level only slightly due to the dilution of the stream. More extensive data collections are seen as desirable. (Poertner) W73-14537

LOUISIANA SUPERPORT STUDIES--REPORT 2, PRELIMINARY ASSESSMENT OF THE EN-VIRONMENTAL IMPACT OF A SUPERPORT ON THE SOUTHEASTERN COASTAL AREA OF

LOUISIANA, Louisiana State Univ., Baton Rouge. Dept. of Marine Science. For primary bibliographic entry see Field 05B. W73-14592

#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Waste Treatment Processes—Group 5D

DEPURATION OF BILOXI BAY OYSTERS BY

RELAYING, Gulf Coast Research Lab., Ocean Springs, Miss. D. W. Cook, and G. W. Childers. Available from NTIS, Springfield, Va. 22151 as COM-72-11177 Price \$3.00, printed copy; \$1.45 microfiche. Project report, June 1, 1972. 6 fig, 2 map, 1 tab, 4 ref.

Descriptors: \*Oysters, \*Water pollution effects, \*Treatment, \*Bays, \*Mississippi, Coliforms, Water quality, Sampling, Data collections, Commercial shellfish, Shellfish farming, Environmental effects.

Identifiers: \*Oyster relaying, Clean water, Oyster

In the fall of 1966, the Microbiology Section of the Gulf Coast Research Laboratory launched a 3 year research project to study the problem of high coliform counts in the waters over some of Missis-sippi's oyster reefs and to study the possibility of dupuration of oysters from closed area by relaying. Experimental depuration studies were conducted in covered racks 30 x 18 x 3 inches, constructed of 1 inch welded wire mesh. Each rack accommodated approximately 80 commercial size oysters. Oysters were harvested with a hand dredge, culled and placed in the rack and immediately transferred to the depuration area. For studies of commercial relaying, the oysters were harvested by a power dredge boat and transported to the depuration area and shoveled overboard. No culling was practiced. The glycogen content was red on a composite sample from 10 oysters. In all depuration studies, oyster samples were col-lected every other day after relaying and analyzed for the coliform MPN and EC positive MPN. Bacteriological studies showed that the depuration of indicator organisms from oysters was achieved in a shorter time than the recommended 15 days. (Woodard-USGS)

RESTORATION OF ALABAMA'S SUPPLY OF

SEED OYSTERS,
Alabama Dept. of Conservation and Natural
Resources, Montgomery.
For primary bibliographic entry see Field 02L.
W73-14595

STUDENT PROJECTS ON COASTAL ZONE AND OFFSHORE RESOURCES MANAGEMENT,

Massachusetts Inst. of Tech., Cambridge For primary bibliographic entry see Field 02L. W73-14615

AQUATIC INSECT COMMUNITIES IN THE RIVERS OF THE YORO, OBITSU, AND ISUMI, CHIBA PREFECTURE, JAPAN, (IN JAPANSES), Freshwater Fisheries Research Lab., Tokyo

For primary bibliographic entry see Field 05B. W73-14617

ENVIRONMENTAL EFFECTS OF HYDRAULIC DREDGING IN ESTUARIES, Alabama Marine Resources Lab., Dauphin Island.

Alabama Marine Resources Bulletin No. 9, p 1-85, Alabama Marine Resources Bulletin No. 9, p 1-85, April 1973, 27 fig, 13 tab, 100 ref. NOAA PL 88-309, Proj. 2-149-R.

Descriptors: \*Environmental effects, \*Dredging, Estuaries, Ecology, Benthos, Hydrology, "Water quality, Biomass, Rivers, Estuarine environment, Channel improvement, Salinity, Circulation, "Sediment transport, "Waste disposal, Sedimenta-tion, Turbidity, "Alabama. Identifiers: Spoil disposal. Hydraulic channel and shell dredging and open water spoil disposal have little significant immediate effect on water quality in Alabama estuaries. Almost all of the sediment discharged by dredges settles very rapidly and is transported by gravity along the bottom as a separate flocculated density layer and potentially harmful components of the mud are not dissolved into the water. There is a limited, temporary reduction in benthic organisms in areas affected by dredging. Spoil piles from channel dredges can indirectly affect the ecology and usefulness of estuaries by interfering with water circulation and altering salinity. The basic hydrological concepts which determine the effects of dredging should be applicable in other areas. Extensive regulations appaently are not areas. Extensive regulations appaently are not necessary to protect water quality in open water dredging situations but spoil disposal practices from channel dredges must be reconsidered and appropriate new disposal plans developed. (Sinha-OEIS) W73-14621

INFORMATION ON THE STUDY OF PHYTOPLANKTON OF THE HIGHER PART OF THE VORSKLA RIVER, (IN RUSSIAN), Leningrad State Univ. (USSR). A. S. Shaaban.

A. S. Shaaban. Vesta Leningr Univ Ser Biol. Vol 26, No 4, p 70-78, 1971. Illus. English summary. Identifiers: Chlorophyta, Cyanophyta, Diatoms, Euglenophyta, "Phytoplankton, Rivers, Seasonali-ty, \*USSR (Vorskla River).

Phytoplankton of the Vorskla river (USSR) were studied in Borisovka, Belgorod region for 6 mo., from April to Sept. 1969. One hundred eightyseven taxa of algae from 8 systematic groups were identified. Phytoplankton of the river sustains its identured. Phytopiankton of the river sustains its diatom character during the period of material collection, but it was found that in summer a considerable growth of Chlorophyta, Cyanophyta and Euglenophyta occurred. It was shown that at the investigation point, phytoplankton had a fresh oligosaprobic character with inclination toward Bmesosaprobic in summer.--Copyright 1973, Biological Abstracts, Inc. W73-14626

EXPERIMENTAL DATA FOR SUBSTANTIATING THE RESIDUAL CONCENTRATIONS OF CHLORINE DIOXIDE IN DRINKING WATER, (IN RUSSIAN).

Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR)

S. A. Fridlyand, and G. Z. Kagan. Gig Sanit. Vol 36, No 11, p 18-21, 1971. Illus. (En-

glish summary). Identifiers: \*Chlorine dioxide, Rats, Residuals, \*Potable water, \*Toxicity, Organoleptic proper-

The intoxication of rats with chlorine dioxide in doses of 0.5 and 5 mg/kg (10 and 100 mg/l) produced a pronounced toxic and resorptive effect. Residual concentrations in the drinking water are suggested by the compounds effect on the organoleptic properties of water.—Copyright 1973, Biological Abstracts, Inc. W73-14707

#### 5D. Waste Treatment Processes

GUIDE TO THE PREPARATION OF OPERA-TIONAL PLANS FOR SEWAGE TREATMENT FACILITIES,

FACILITIES,
Synectics Corp., Allison Park, Pa.
E. L. Seiler, and J. W. Altman.
Copy available from GPO Sup Doc as
EP1.23/2-73-263, \$2.60; microfiche from NTIS as
PB-223 346, \$1.45. Environmental Protection
Agency, Technology Series Report, EPA-R2-73263, July 1973, 212 p. 39 fig, 14 tab. EPA Project
1709 FWA. Contract 68-01-0073.

Descriptors: \*Management planning, \*Operations research, \*Operation and maintenance, \*Optimization, Manpower, Systems engineering, Human resources, Operations, Publications, \*Treatment facilities, Wastewater treatment,

Sewage treatment.
Identifiers: Job aids, Performance standards, Performance aids, Management data, Operator data, maintenance data, \*Human engineering, Job anal-

A proceduralized methodology is provided to guide the initial and ongoing planning necessary for extracting maximum potential from wastewater treatment plants. The objective of the planning activities is the development of conceptual and applied tools for direct use by plant personal in the plant personal pl sonnel in optimizing the cost-effectiveness of their plant, complementing the design engineering of the physical plant. The main body of the Guide is divided into five major steps, representing a proceduralized methodology for developing operational planning materials. The contents and sequencing of these steps are designed to rationally combine operational planning and design engineering. Heavy emphasis is placed on general methods and principles which can be applied to a wide variety of specific treatment plant designs and situations. The four appendixes of the Guide provide a detailed classification and description of planning materials deemed essential to plant functions of management, operations, and maintenance. Job descriptions, plant manuals, checklists, reference materials, task schedules, decision tables, and operating records are among sonnel in optimizing the cost-effectiveness of their decision tables, and operating records are among the specific materials designed to support the above personnel functions. Thus, the appendixes serve to define the nature of the planning outputs while the five procedural steps of the main body provide a framework for their development. (EPA) W73-14214

PREDICTING AND CONTROLLING RESIDUAL CHLORINE IN COOLING TOWER BLOW-

DOWN, Pacific Northwest Environmental Research Lab., Corvallis, Oreg. National Thermal Pollution Research Program.

Research Program.
G. R. Nelson.
Copy available from GPO Sup Doc as
EP1.23[2-72-273, \$0.80; microfiche from NTIS as
PB-223 378, \$1.45. Environmental Protection
Agency, Technology Series Report EPA-R2-73273, July 1973. 48 p, 12 fig. 11 ref.

Descriptors: \*Chlorination, \*Chlorine, \*Water treatment, \*Cooling towers, \*Mathematical models, Recirculated water, Biocontrol, Chemcontrol, Monitoring, Forecasting, Identifiers: \*Blowdown control, Residual chlorine, Splitstream chlorination.

A mathematical model which predicts and controls residual chlorine levels in cooling tower blowdown is developed and analyzed. The model has eight variations to allow for (a) the fraction of the recir-culating water chlorinated, (b) the type of chlorine feed equipment used, and (c) the time length of the chlorine feed period. The variations to the model chlorine leed period. The variations to the model are useful not only in predicting residual chlorine levels in the blowdown, but also in making alterations in existing chlorination programs which minimize chlorine waste, provide more disinfecting efficiency, and reduce residual chlorine levels in the blowdown. (EPA)

ELECTRICAL POWER CONSUMPTION FOR MUNICIPAL WASTEWATER TREATMENT, National Environmental Research Center, Cincinnati, Ohio. Advance Waste Treatment Research

R. Smith.

Copy available from GPO Sup Doc as EP1.23/2:73-281, \$1.25; microfiche from NTIS as PB-223 360, \$1.45. Environmental Protection

#### **Group 5D—Waste Treatment Processes**

Agency, Technology Series Report EPA-R2-73-281, July 1973. 89 p. 14 fig, 15 tab, 12 ref. EPA Pro-gram Element 1B 2043.

Descriptors: \*Waste water treatment. \*Electrical power demand, \*Electric power costs, Sewage treatment, Sewage, Cost comparisons, Treatment facilities, Municipal water. Identifiers: \*Electrical power consumption

Electrical power consumption by most conventional and advanced processes for treating mu-nicipal wastewater has been estimated on a unit process basis. Electrical power for complete plants has been estimated by adding power con-sumption for individual processes and plant utilities. Electrical power consumption for wastewater treatment has been compared to other consump-tive uses of electrical power. (EPA)

#### STUDY OF UPFLOW FILTER FOR TERTIARY TREATMENT

Jefferson Parish Dept. of Sanitation, Metairie, La. J. E. Morrison.

Available from the National Technical Informa-tion Service as PB-223 354, \$5.25 in paper copy, \$1.45 in microfiche. Environmental Protection Agency Report EPA-670/2-73-074, September 1973, 62 p. 19 fig. 2 tab. EPA Project 17030 DMA.

Descriptors: \*Filtration, \*Tertiary treatment, Sand filters, Separation techniques, Sewage treatment, \*Waste water treatment.

Identifiers: \*Upflow filter, \*Suspended solids removal, Upgrading secondary effluent.

A sand-media upflow filter was installed at an existing trickling filter sewage treatment plant which receives combined domestic and industrial waste, to test its effectiveness in a tertiary treatment function. Preliminary testing was performed at three different flow rates and with different chemicals as flocculants and coagulant aids to determine optimum conditions for final, full-scale testing. In the final, full-scale test phase, a flow rate equivalent to 0.5 MGD was used, and alum was injected as required to produce satisfactory turbidity levels in filter effluent. The operation was monitored constantly for flow rate, inlet pressure, water temperature and alum input; influent and effluent values for turbidity, suspended solids, BOD, COD, total phosphate, orthophosphate and pH were determined. Filter performance was inconsistent and generally unpredictable. Alum as a coagulant was effective as an aid in contaminant reduction; however, the alum floc proved weak and its use resulted in short filter cycles. Polyelectrolytes used as coagulant aids to the alum proved ineffective in developing floc strength and extending the cycle duration. W73-14217

#### SLUDGE PROCESSING FOR COMBINED PHYSICAL-CHEMICAL-BIOLOGICAL

Brown and Caldwell, Inc., San Francisco, Calif. D. S. Parker, F. J. Zadick, and K. E. Train. Copy available from GPO Sup Doc as EP1.23/2:73-250. \$2.10: microfiche from NTIS as PB-223 341, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-250, July 1973. 141 p, 54 fig, 28 tab, 23 ref. EPA Project 17080 FSF. R801445.

Descriptors: "Sludge disposal, "Sludge treatment, Ultimate disposal, "Dewatering, Chemical precipitation, "Sludge digestion, Centrifugation, Solid wastes, "Waste water treatment. Identifiers: "Chemical sludge processing, Centrifugal classification, Centrifugal dewatering, Recalcination, Chemical treatment.

Full scale combined sludge generation from a treatment sequence consisting of lime clarifica-tion, nitrification, and dentrification was studied. tion, nitrification, and dentrification was studied. Pilot scale studies were conducted to wet-classify and dewater the combined sludges by means of two-stage solid bowl centrifugation. Anaerobic digestion of first stage centrate was also studied on a pilot scale. Predicted and measured sludge production agreed well using four coagulation production agreed well using four coagulation modes in the primary. First stage centrifugation (wet classification), over a wide pH range, achieved high capture of calcium carbonate in relatively dry (42 to 57 percent total solids) cakes as well as good rejection of magnesium, phosphorus, and iron compounds in the centrates. At pH 11.0 or below, second stage centrifugation dewatered first stage central to produce 18 perdewatered first stage centrate to produce 18 per-cent total solids cakes, with 80 percent solids recoveries. Dewatering deteriorated at a pH greater than 11.0. Anaerobic stabilization of thickened and unthickened first stage centrates showed volatile matter destructions of over 40 percent, high methane-content gas, and substantial in-creases in soluble magnesium and alkalinity during digestion. This investigation was a joint effort of the Central Contra Costa Sanitary District, Walnut Creek, California, and its consultant, Brown and Caldwell. (EPA) W73-14218

### DENTRIFICATION BY ANAEROBIC FILTERS

AND PONDS - PHASE II. Environmental Protection Agency, San Francisco, Calif. Water Quality Office.

Bio-Engineering Aspect of Agricultural Drainage, San Joaquin Valley, California, June 1971. 34 p, 12 fig, 4 tab, 6 ref. EPA Project 13030 ELY 06/71-14.

Descriptors: \*Agricultural wastes, \*Dentrification, \*Irrigation water, Return flows, Nitrate, Anaerobic treatment, \*Waste water treatment, Anaerobic treatment, "Waste water treatment, "California, Filters, Filtration. Identifiers: "San Joaquin Valley (Calif), Bacterial dentrification, "Anaerobic filters, Anaerobic

Operational criteria, design and operations costs operational criteria, design and operational criteria, design after a treatment facility to remove nitrogen from agricultural tile drainage in the San Joaquin Valley were further investigated during 1970 at the Interagency Agricultural Wastewater Treatment Center near Firebaugh, California. The year-long study period is identified as Phase II. Based on projected nitrate-nitrogen concentrations for valley tile drainage water, the research in this phase extended earlier Phase I studies on the feasibility of bacterial dentrification by filters and covered ponds. The anaerobic filter with 1-inch rounded aggregate was capable of reducing influent nitrate-nitrogen from 30 mg/l at water temperatures from 12 to 16C at a 6-hour detention time, and from 15 mg/l to 2 mg/l at water temperatures of 10 to 24C at 1-hour detention time. Long-term operation of fil-ters resulted in accumulation of bacterial mass which caused the deterioration of the hydraulic regime and nitrogen removal efficiencies. Air scour accompanied or followed by flushing with water was capable of controlling the bacterial mass. The consumptive ratio, a method to quantify the organic carbon source needed for anaerobic bacterial process, was affected by temperature and influent nitrogren concentration and was found to vary between approximately 1.2 and 2.4. The anaerobic covered pond reduced influent peratures of 12 to 16C with a 60-day detention time and from 15 mg/l to 2 mg/l at 20 to 2-C with a 10-day detention time. (Jones-EPA) W73-14219

INSTREAM AERATION TO CONTROL DIS-SOLVED SULFIDES IN SANITARY SEWERS, Jefferson Parish Dept. of Sanitation, Metairie, La. K. L. Condon, Jr., R. A. Cooper, Jr., and A. J.

Avanators from the National Technical Informa-tion Service as PB-223 342, \$7.25 in paper copy, \$1.45 in microfiche. Environmental Protection Agency Report EPA-670/2-73-024, September 1973. 32 p. 34 fig. 6 tab. 10 ref. EPA Project 11010 ELP. WPRD 121-01-68. Available from the National Technical Informa-

Descriptors: \*Sulfides, \*Odor, \*Corrosion control, Aeration, Sewers, \*Waste water treatment, Oxygen demand.

Identifiers: \*Sulfide oxidation, Upstream aeration, Aspirators, \*Instream aeration, Venturi aspirated U-tubes, Oxygen transfer.

Field studies were conducted employing full scale prototypes of four aeration devices installed in a sanitary sewage collection system. The devices used included an in-line Venturi aspirator, an inline Vortex-Shear aspirator, an in-lift pump, and Venturi aspirated U-tubes. Only the Venturi aspirated U-tubes proved to be satisfactory under the conditions of this study. The U-tube installed on the end of a sewage force main reduced dis solved sulfides, at a sampling station 1500 ft downstream, from .03 mg/l to .02 mg/l (equivalent to a 12 min detention). Additionally, the U-tube virtually eliminated the stripping of H2S in the discharge manhole where a severe odor problem and corrosive attack had existed. Oxygen demand in the force main immediately upstream of the U tube averaged 2.5 mg/l. Oxygen transfer in the Utube averaged 5.1 mg/l with residual dissolved oxygen in the effluent averaging 2.6 mg/l. As installed, and with oxygen transfer averaging 5.1 mg/l, no modification of existing pumps was required. Higher transfer concentrations approaching 7 mg/l were obtained with Venturi aspiration, but resulted in increased pump head requirements. Transfer concentrations up to 8 mg/l were obtained with forced air injection, but did not appear to justify the added cost of blowers and greatly increased pump head requirements. No maintenance was required on either of the two Venturi aspirated U-tubes during two years of continuous operation in this demonstration. This report was submitted in fulfillment of a grant to the Department of Sanitation, Jefferson Parish, Metairie, Louisiana. (EPA) W73-14220

# SLUDGE CONDITIONING USING SO2 AND LOW PRESSURE FOR PRODUCTION OF OR-GANIC FEED CONCENTRATE, Snell (Foster D.), Inc., Florham Park, N.J. M. S. Weinberg, H. K. Weiss, A. L. Palanker, and

A. L. Sheffner.

A.L. Shettner.
Available from the National Technical Informa-tion Service as PB-223 343, \$10.50 in paper copy, \$1.45 in microfiche. Environmental Protection Agency Report EPA-670/2-73-062, September 1973, 155 p., 11 fig., 119 tab, 11 ref. EPA Project 17070 EKN, Contract 14-12-813.

Descriptors: \*Activated sluge, \*Sewage treatment, \*Sewage sludge, \*Dewatering, \*Sulfur compounds, Filtration, Chemical degradation, Municipal wastes, Sulfur dioxide, \*Waste water treatments.

nicipal wastes, solitur dioxide, "waste water treat-ment, Cost analysis. Identifiers: Animal feed supplement, Reproduc-tive performance, Nutritional value, Treatment costs, Teratogenic effects, Organic feed concen-

Activated sludge from four municipal sewage plants was treated with 0-5%SO2 at pressures of 50-100 psig. The filterability of the treated sludges was improved and the treatment solubilized from 26 to 44% of the initial insoluble solids. The clear, light yellow filtrates were concentrated and then spray-dried to flowable, hygroscopic, tan powders having nutritional value as an animal feed supple-Capital investment and manufacturing costs for a plant producing 900 tons per year of a 50% concentrate or 450 tons per year of dry product was estimated at \$223,000 and \$273,000 with manufacturing costs of 6. I cent and 13.2 cent per pound respectively. Effects on reproductive p

formance of this organic feed concentrate (OFC) were investigated in rats, rabbits and chickens using nutritionally balanced diets. No teratogenic effects were seen in rats or rabbits fed 5% or 10% OFC. No alterations in reproductive parameters wee noted in rats fed 5% OFC. Increased food intake and body weight gains were observed (5% OFC male and female rats) during the pre-mating feeding period. At 10% OFC levels, reduced Fertility, Viability and Lactationindexes were seen in rats and egg laying performance of chickens was suppressed. (EPA)

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RENOVATING SEWAGE EFFLUENT BY GROUNDWATER RECHARGE,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman C. Bouwer, J. C. Lance, and R. C. Rice.
In: Proceedings, 16th Annual Water Conference,
New Mexico Water Resources Research Institute,
Las Cruces, March 25-26, 1971, p 32-46, 3 fig, 2 tab, 14 ref.

Descriptors: \*Groundwater recharge, \*Water reuse, \*Hydrogeology, \*Waste water treatment, Activated sludge, Biochemical oxygen demand, Chemical oxygen demand, Phosphates, Nitrates, Boron, Ammonia, Infiltration, Cost analysis, Pilot plants. plants.
Identifiers: \*Groundwater table. \*Inundation.

Continues.

Continued population growth in the Salt River Valley has stimulated interest in systems for reuse of municipal sewage effluent. Pilot plant studies of groundwater recharge of municipal activated sludge effluent were initiated in 1967. The secondary effluent contained 15 mg/l BOD, 50 mg/l COD, 25 ppm ammonia nitrogen as N, 13 ppm phosphate, and 4.5 ppm fluorides. The river bed, through which the water passed, was composed of 9 ft. of the fine loamy sand underlain by sand and gravel layers to great depth, with a groundwater table at about 10 ft. Water was pumped from one 30 ft. deep well in the center of the infiltration area, and from another well 1000 ft. from the center of the infiltration basins. Reclaimed water pumped from the well in the center of the infiltration center of the infiltration basins. Reclaimed water pumped from the well in the center of the infiltration area contained 0.5 mg/l BOD, 17 mg/l COD, no ammonia nitrogen for short (2-3 day) inundations and 40 to 80% less than influent NH3-N concentrations for 2 to 3 week inundations, 5 ppm phosphates, 2.5 ppm fluorides, and a median fecal coliform density of 10 per 100 ml. Concentrations of most constituents were further reduced by of most constituents were further reduced by horizontal travel. Cost of the system was estimated at \$5/acre-ft. with minimum underground travel distance and detention time of 500 ft. and 1 month respectively. Cost of conventional, in-plant tertiary treatment was reported as more than 10 times the estimate cost for groundwater recharge treatment. (See also W73-14224) (Lowry-Texas) W73-14225

MATHEMATICAL SIMULATION OF AM-MONIA STRIPPING TOWERS FOR WASTE-WATER TREATMENT, Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. J. F. Roesler, R. Smith, and R. G. Eilers.

Available from National Technical Information Service, Springfield, Va., 22151 as PB-220 057, \$3.00 in paper copy, \$1.45 microfiche. FWQA Re-port, January 1970. 73 p, 17 fig, 3 tab, 27 ref. EPA Project 17090--1/70.

Descriptors: Water pollution, \*Waste water treatment, Capital costs, \*Sewage treatment, Operating costs, Maintenance costs, Sanitary engineering, Ammonia, Mathematical models, Simulation analysis, Model studies, \*Tertiary treatment, \*Cooling towers, \*Computer programs. Identifiers: \*Ammonia stripping towers, Unit process models.

This computer program (FORTRAN, IBM 1130) can be used for preliminary design and cost estimation of ammonia stripping towers and cooling towers used in the treatment of wastewater. Crosstowers used in the treatment of wastewater. Cross-current and countercurrent tower configurations are included in the program. This mathematical model considers the effect of temperature drop thoughout the stripping tower. Capital and opera-tion and maintenance costs are also calculated. (EPA) W73-14229

WATER DISTRIBUTION AND WASTEWATER COLLECTION SYSTEMS IN FORSYTH COUN-TY, NORTH CAROLINA WITH URBAN DEVELOPMENT FORECASTS: 1968-1978-2010. City-County Planning Board, Winston-Salem,

July 1968. 52 p, 9 fig, 21 tab, 3 append.

Descriptors: \*Water supply, \*Waste water disposal, Sewage disposal, Septic tanks, Planning, \*North Carolina, Treatment facilities, \*Sewers, Utilities, \*Waste water treatment, Urbanization,

Identifiers: \*Utilities extension, Winston-Salem (N.C.), Forsyth County (N.C.).

The case for public sewers serving Forsyth County is built primarily upon potential health hazards of septic tanks throughout urbanizing areas. Time, increased density, and poor soils in developing districts will increase the danger of septic tank failure. Existing and programmed water supply programs are described, as well as existing waste water disposal systems. It is recommended that water not be provided to any areas in the absence of a wastewater disposal system. A unified county water not be provined to any areas in the absence of a wastewater disposal system. A unified county approach is urged for provision of these services. Because of the financial infeasibility of servicing outlying districts, the study urges that development in these districts be discouraged by strict was the study and and seculations. The study ment in these districts be discouraged by strict utility policy and land regulations. The study defines and proposes an approximate public utilities district for the county, based on considerations of population projections and drainage patterns. Consideration is given to financing utilities extension. (Stein-North Carolina) W73-14233

LANCASTER COUNTY, PENNSYLVANIA, COMPREHENSIVE SEWERAGE PLAN. Huth Engineers, Inc., Lancaster, Pa. For primary bibliographic entry see Field 05G. W73-14234

CITY OF ESCONDIDO AND VISTA IRRIGA-TION DISTRICT FEASIBILITY STUDY OF JOINT FILTRATION PROGRAM. Montgomery (James M.), Inc., La Jolla, Calif. For primary bibliographic entry see Field 05F. W73-14240

TOXICITY ASSESSMENT OF TREATED MU-NICIPAL WASTEWATERS, California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05C.
W73-14258

MICROBIOLOGY OF WASTE TREATMENT, Pennsylvania State Univ., University Park. R. F. Unz.

Journal Water Pollution Control Federation, Vol. 45, No. 6, p 1259-1265, June 1973. 67 ref.

Descriptors: Waste water (Pollution), \*Nutrient removal, \*Microorganisms, \*Bibliographies, \*Microbial degradation, Pollutant identification, \*Reviews, \*Microbiology, Waste treatment, Sewage treatment, Growth rates, Algae, Rotifers, Protozoa, Organic matter, Viruses, Proteins, Car-

bohydrates, Phenols, Sewage sludge, Scum, Pseudomonas, Activated sludge, Alcohols, Organic acids, Systematics, Sulfides, Cultures, Coliforms, acids, Systematics, Sulfides, Cultures, Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Phosphorus, Nickel, Heavy metals, Nitrogen, Nutrients, Flocculation, Nematodes, Amino acids, Iron, Hydrogen sulfide, Waste treatment, Denitrification, Oxidation, Nitrification, Acetates, Formates, Hydrogen, Methane, Carbon, Lipids, Aluminum, Chlorination, Chlorine, Salmonella, E. coli, Sulfates, Humic acids, Bacteriophage.

monella, E. coli, Sulfates, Humic acids, Bacteriophage.
Identifiers: Survival, Inactivation, o-Cresol, m-Cresol, p-Cresol, Benzoates, m-Toluate, p-Toluate, Zoogloea ramigera, Actromobacter, Alcaligenes, Acrobacter, RNA, DNA, Polysaccharides, Sporosarcina ureae, Agars, Thiothrix, Culture media, Formic acid, Arsenic, Ciliates Phicanod. Thiothrix, Culture media, Formic acid, Arsenic, Ciliates, Rhizopods, Aspidisca costata, Aspidisca Iynceus, Pseudomonas denitrificans, Bacillus, Psychoda, Sugars, Enrichment, Fatty acids, Valerate, Caproate, Polysaccharides, Pseudomonas aeruginosa, Polioviruses, Coxsackie viruses, Salmonella paratyphi, Tetrahymena pyriformis, Acanthamoeba hartmanella, Shigella flexneri, Fecal coliforms, Mycobacterium, Desul-fovibrio desulfuricans.

The 1972 literature is reviewed on the identification of microorganisms in wastewaters and their abilities to degrade or remove pollutants and nutrients. Optimum conditions for growth of the organisms are also considered. (Little-Battelle) W73-14261

DISCHARGE OF NITRILOTRIACETATE (NTA) FROM TWO SEWAGE TREATMENT FACILI-TIES LOCATED IN A MIDCONTINENTAL CLI-

Fisheries Reasearch Board of Canada, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 05B. W73-14294

PROTEINS IN WASTEWATER AND WASTE-WATER SLUDGES, Indian Inst. of Science, Bangalore. Dept. of Biochemistry. For primary bibliographic entry see Field 05A.

DETERGENTS, Matz, Childs, and Associates, Baltimore, Md. For primary bibliographic entry see Field 05B.

W73-14311

FACTORS INFLUENCING THE FREQUENCY OF SAMPLING, PEDCo-Environmental Specialists, Inc., Cincinnati, Ohio. For primary bibliographic entry see Field 05A. W73-14324

FEASIBILITY STUDY OF A NUCLEAR POWER-SEWAGE TREATMENT SYSTEM FOR THE CONSERVATION AND RECLAMATION OF WATER RESOURCES, Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.

R A Sierka

Available from the National Technical Information Service as PB-223 501, \$2.75 in paper copy, \$1.45 in microfiche. Completion Report, August 1973. 12 p, 2 fig, 3 tab, 3 ref. OWRR A-028-ARIZ (2). 14-31-0001-3503.

Descriptors: \*Waste water treatment, \*Sewage treatment, Reclaimed water, \*Thermal pollution, Nuclear Powerplants, \*Activated carbon. Identifiers: \*Heated Sewage.

#### Group 5D-Waste Treatment Processes

Seventy percent of the energy produced in a nuclear power reactor is rejected to the environ-ment as low quality heat. One possible use of this heat source is for domestic wastewater treatment. heat source is for domestic wastewater treatment. This study examined a ferric-chloride, powered activated carbon and an aluminum sulfate, powered activated carbon physical-chemical system in a one-step process as a function of tem-perature (20-80C). COD, suspended solids, turbidity and phosphorus removals were used to monitor performance. Significant improvement in pollutant performance. Significant improvement in poliutant removals was obtained at higher temperatures with the optimum results occurring between 50 and 60C. Since urban wastewater flow and electric power usage are population-dependent and the system optimum treatment temperature coincides waste heat characteristics, a combined power plant-wastewater system would generate recycle Water.

PHOSPHORUS REMOVAL BY TRICKLING

FILTER SLIMES, Marquette Univ., Milwaukee, Wis. Dept. of Civil

Engineering. A. E. Zanoni

Copy available from GPO Sup Doc as EP1.23/2, 73-279, \$2.10; microfiche from NTIS as PB-223 534, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-279, July 1973. 122 p, 4 fig, 24 tab, 40 ref. EPA Project 17010

Descriptors: \*Phosphorus, \*Biological treatment, Nutrients, \*Slime, Minerals, \*Waste water treatment, Equipment, Trickling filters, Nitrogen, Metabolism.

Identifiers: Attached growth, Synthetic media, Research apparatus.

A rotating disc apparatus was constructed so that disc speed could be varied. Organisms that developed on the disc surface, in response to vari-ous nutrient solutions, could be harvested and analyzed. Correlations were attempted between mineral composition of the feed solutions and the phosphorus and nitrogen content of the resulting slimes. An inclined channel apparatus was also constructed and evaluated to differentiate physical or chemical mechanisms from biological mechanisms of phosphorus uptake. The angle of inclination was used to measure the kinetic rates before and after inactivation of the biological slime with ultraviolet light. With the disc apparatus, limited success of inducing biological up-take of phosphorus, in excess of 1.5 to 2.5 percent of the cell mass, was obtained. Statistical analysis of the data indicated that those values above 2.5 percent usually were encountered when the medi-um contained calcium salts. Results from the um contained calcium saits. Results from the inclined plane growth chamber showed that the limited phosphorus uptake that did occur could be related to metabolic activity rather than physical sorption or chemical precipitation. (EPA) W73-14372

PRESSURE FILTRATION OF WASTE WATER SLUDGE WITH ASH FILTER AID.

r Rapids Water Pollution Control Plant, Iowa.

J. W. Gerlich.

Copy available from GPO Sup Doc as EP1.23/2,
73-231, \$2.10; microfiche from NTIS as PB-223

535, \$1.45. Environmental Protection Agency,
Technology Series Report EPA-R2-73-231, June
1973. 153 p, 64 fig, 14 tab. EPA Project 11060

EZX.

Descriptors: Sludge, \*Dewatering, \*Iowa, \*Sludge treatment, Filters, \*Waste water treatment, Pressure, \*Filtration. Identifiers: Ash filter aid, \*Pressure filtration,

Cedar Rapids (Iowa).

Cedar Rapids, Iowa used pilot plant studies as an effective approach to an economic solution to dewatering secondary digested sluge. After piloting several dewatering processes, the pressure filter system was selected and a full scale plant was constructed. During the course of the dewatering studies it was observed that fly ash was an effective filter aid. The full scale plant was designed to utilfilter aid. The full scale plant was designed to utilize sludge ash from incinerated filter cake, as well as power plant fly ash. The design capacity is 28 tons of dry sewage solids for 16 hour operation at 48 percent dry solids cake. Performance data from the full scale plant were evaluated over a period of approximately nine months. Both fly ash and sludge ash were evaluated as a filter aid, with and out chemicals. Economic evaluations were made of operation and equipment. Some conclusions are: (1) Pressure filtration of waste water sludges is an effective and economical process. (2) Ash filter aid increases dewatering production and decreases chemical costs. Sewage sludge ash from cinerator can be recycled to process; pow an incinerator can be recycled to process; power plant fly ash is even more effective sludge conditioner. (3) A detailed pilot plant program is of great value in design of a full scale plant. (4) Some chemicals in combination with ash filter aid further improve dewatering efficiencies. (EPA) W73-14374

REVERSE OSMOSIS FOR WASH WATER

Envirogenics Systems Co., El Monte, Calif. R. W. Lawrence.

Available from the National Technical Informa-tion Service as PB-220 389, \$1.45 in microfiche. Office of Saline Water Research and Develo Progress Report No. 848, May 1973. 24 p, 4 fig, 6 tab. OSW contract 14-30-2815.

Descriptors: \*Water reuse, \*Reverse osmosis, \*Water purification, Separation techniques, Membranes, Pressure, Water treatment, Detergents, Flocculation, \*Pre-treatment (Water), \*Waste Flocculation, "Pre-treatment (water), "Waste water treatment, Recovery, Filtration. Identifiers: Wash water, Laundry wash water, Laundry mash water, Sprain module, Wash water analysis, Alum flocculation, Cellulose acetate membranes.

A 34-day run was made at 165F under an operating pressure of 800 psig with the synthetic wash water containing 1000 ppm sodium lauryl suflate. The flux decline parameters were 0.17 and 0.067 for blend and cellulose acetate methacrylate (CAM) membranex, respectively, and the extrapolated flux at six months were 13 and 19 gfd, respectively. The rejections obtained with blend and CAM membranes were low for urea (37 to 46%), strongly pH dependent for lactic acid (84 to 98%), strongly pH dependent for factic acts (94 to 38%) and good for sodium lauryl sulfate (92 to 98%) and excellent for sodium chloride (99.4% for blend membrane and 98.9% for CAM membrane). Many tests on the bacterial content of the product water and the recycle stream when operating at 165F showed that they were sterile. This proved to be true for both synthetic and real wash water. A 2-in. dia. by 22-in. spiral module containing 4.5 sq ft of blend membrane was operated satisfactorily for 30 days membrane was operated satisfactorily for 30 days at 165F, 400 psig, and 64-77% product recovery. The membrane support was stiffened by the use of Mylar sheet between two pieces of Dacron-tricot substrate. Pretreatment of the wash water consisted of filtration through 30, 23 and 0.45 micron fulted filters. Sulfuric acid was added periodically to keep the pH between 6 and 8.5. Increasing the flow rate from 0.5 gpm to 0.9 gpm daily aided maintaining product flux, which was initially 12.0 and 6.5 gfd at the end of 30 days operation. (OSW) W73-14387

A PILOT PLANT INVESTIGATION OF THE PULSED ADSORPTION BED PROCESS. Iowa State Univ., Ames.

S. R. Sedgewick. Master's Thesis, 1969, 138 p, 37 fig, 12 tab, 13 ref.

Descriptors: \*Adsorption, \*Tertiary treatment, \*Organic loading, Efficiencies, Biodegradation,

Separation techniques, Colloids, \*Pilot plants. \*Waste water treatment.

Identifiers: \*Pulsed adsorption beds, Hydraulic loading, \*Total organic carbon, Suspended solids

A pulsed adsorption bed (PAB) pilot plant was operated for 82 days to determine: (1) the relation-ship between influent total organic carbon and oval efficiency at various hydraulic loadi removal efficiency at various hydraunic loadings; (2) if a relationship exists between influent soluble fraction and hydraulic loading; and (3) if relation-ships exist between removal efficiency of the in-fluent solid plus colloidal fraction and hydraulic Intent sone puts contoun traction and nydrature loading. Organic loadings of 97, 161, and 223 lb BOD applied/1000ft3/day at respective hydralic loadings of 0.70, 1.15 and 1.60 gpm/ft2 were applied to the system. For both the total and colloidal plus suspended samples, highest total organic removal efficiency was obtained at the lowest hydraulic loading rate investigated and converse-ly, while removal efficiency for the soluble fracwas essentially constant at all hydraulic loadings. In addition, the non-biodegradable fracloadings. In addition, the non-biodegradable fraction of the waste appeared to increase with increased hydraulic loading. Overall, an increase in removal efficiency was shown to occur with an increase in influent concentration, with such increase being highly dependent upon the concentra-tion of the non-degradable portion of the influent. Areas requiring further study include relationships between removal efficiency and both bed depth and air flow rate, as well as cost estimates. (Lowry-Texas) W73-14389

CANADA ANIMAL WASTE MANAGEMENT GUIDE.

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Department of Agriculture, Ottawa (Ontario). Animal Waste Management Guide Committee. For primary bibliographic entry see Field 05G. W73-14392

INFLUENCE OF SURFACE OXIDES ON AD-SORPTION AND CATALYSIS WITH AC-TIVATED CARBON.

Maryland Univ., College Park. Dept. of Civil Engineering. C. Ishizaki, and J. T. Cookson, Jr.

Available from ACS-Div of Water, Air and Waste Chem., Publications Manager, Mellon Inst., 440. Fifth Aven., Pittsburgh, Pa. 15213, Price \$4.00. In Preprints of Papers Presented at 165th National feeting of American Chemical Societt, April 8 Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 53, p 51-53, 1973.

Descriptors: \*Adsorption, \*Water treatment, \*Organic compounds, \*Activated carbon, Water purification, \*Waste water treatment, Organic

Identifiers: Mercaptans, Disulfides, Hydrocar-

The influence of surface oxides is evaluated for the adsorption of several organics on Filtrasorb 200, an activated carbon. The absorbates include p-hydroxybenzaldehyde (representative of degradation products of larger color-producing compounds), n-butyl mercaptan and butyl disulfide (paraffinic molecules found responsible for taste and odor problems in water), decane (a non-polar molecule), and glycine (a polar compound). The surface of the carbon, originally basic in nature, is modified by outgassing followed by dry oxidation at several temperatures. Equilibrium as well as kinetic studies were performed in batch The influence of surface oxides is evaluated for well as kinetic studies were performed in batch systems. For all the adsorbates studied the equilibrium can be described by the Langmuis equinforum can be described by the Langmuir equation. The monolayer coverages are in the order of a few millimoles per square meter. The activated carbon was found to catalyze the oxida-tion of n-butyl mercaptan to butyl disulfide. A mechanism is proposed to explain this catalytic ef-fect. The rates of adsorption are studied for all the

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adsorbates. The presence of acidic surface oxides ausorpates. The presence of acidic surface oxides strongly hinders the adsorption of decane and butyl disulfide, but it does not seem to influence the adsorption of the aromatic. (Knapp-USGS) W73-14394

KINETICS OF VIRAL INACTIVATION BY

RPOMINE

North Carolina Univ., Chapel Hill. Dept. of En-North Caronna Univ., Chapel Hill. Dept. of vironmental Sciences and Engineering. For primary bibliographic entry see Field 05F. W73-14395

THE DISINFECTION OF SEWAGE BY CHLOROBROMINATION,

Dow Chemical Co., Midland, Mich. Hologens Research Lab.

J. F. Mills.

Available from ASC-Div of Water, Air and Waste Chem., Publications Manager, Mellon Inst., Fifth Ave., Pittsburgh, Pa. 15213, Price \$4.00. In: Preprints of Papers Presented at 165th National Meeting of American Chemical Society, April 8-13, 1973, Dallas, Tex: American Chemical Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 71, p 65-75, 1973. 3 fig, 2 tab, 10 ref.

Descriptors: \*Bromine, \*Bromides, \*Disinfection, \*Sewage treatment, \*Waste water treatment, Tox-

Identifiers: \*Bromamines, \*Chloramines.

The chemical and biocidal properties of bromine chloride and the instability of bromamines in sewage make chlorobromination an attractive alternative to chlorination and a potential solution to this problem. In comparing chlorination and chlorobromination of secondary sewage effuent versus nitrified secondary sewage effluent, the effects of ammonia concentration, pH, temperature, halogen dosages, and halogen demand are important factors influencing both biocidal activity and fish toxicity. Some of the conclusions are: BrC1 forms less stable bromamine residuals: BrC1 shows higher biocidal activity without fish toxicity hazards: BrC1 is more effective over a wider pH range; and BrC1 has advantageous chemical and physical properties (higher solubility and lower volatility.) (Knapp-USGS) W73-14396

WASTEWATER CONVEYANCE MODELS. For primary bibliographic entry see Field 05G. W73-14465

HAZARDS ASSOCIATED WITH THE USE OF CHLORINATED OXIDATION P FLUENTS FOR IRRIGATION, Technion - Israel Inst. of Tech., Haifa. POND EF-

V Kott

Water Research, Vol 7, p 853-862, 1973. 7 tab, 17

Descriptors: \*Chlorination, Effluents, Hazards, \*Irrigation water, \*Oxidation lagoons, Water quality control, \*Water reuse, Water treatment, \*Waste water treatment.

In Israel more than 200 oxidation ponds are in use, most of them serving rural communities. It is natural to assume, therefore, that in a country where about 90 percent of the water resources are utilized, most of the oxidation pond effluents will be ized, most of the oxidation pond effluents will be used for irrigation. Reuse of wastewater for agricultural purposes is dependent on health hazards being overcome. Investigations using 8 miligrams per litre chlorine applied to oxidation pond effluents caused no algal kill within the first 2 hours of contact. Available chlorine attacks bacteria, causing coliform count to drop from 100,000 per 100 ml to a few tens. Enterovirus counts dropped from about 80 per 100 ml to 37 per 100 ml after chlorination. Vibro cholerai (El-Tor) were killed under these conditions, and MPN dropped from 1000 per 100 ml in the influent wastes to 2 per 100 ml in the effluents. A 5 mg per 1 dose of chlorine at 1 h contact time killed these sensitive chiorine at 1 h contact time killed these sensitive bacteria, decreasing MPN to less than 2 per 100 ml. 'Differences' between the efficiency of chlorination experiments under laboratoryand field conditions would necessitate the application of 15 mg per 1 chlorine for 2 h of contact. Further eeded before unrestricted use of oxida tion pond effluents for irrigation purposes is safe unless strict regulations are issued. (Bahre-Arizona) W73-14480

WATER, SEWER, AND STORM DRAIN STUDY, UTAH COUNTY, UTAH, VOLUME BACKGROUND AND INVENTORY. Desnain (I Dale) and Associates Provo Litah

Prepared for Utah County Council of Govern-ments, September 1972, 238 p. 34 maps, 97 tab.

Descriptors: \*Water supply, \*Sewerage, \*Water demand, \*Urban land use, \*Storm drains, Planning, Water quality, Urbanization, Waste disposal, Governmental interrelations, Inter-

disposal, Governmental interretations, inter-Agency cooperation. Identifiers: \*Utility extension, \*Utah County (U-tah), Provo (Utah), Utah Valley (Utah), Four Cor-ners Economic Development Region.

The purpose is to assess the adequacy of existing water, sewage, and storm water systems and facilities throughout Utah County and to demonstrate the most cost effective method of providing water, sewer and storm drain service to the present and future inhabitants, consistent with its adopted Land Use Plan. This area of 1,370,240 adopted Land Use Plan. Ins area of 1,30,240 acres in north central Utah, including 92,000 acres of water surface represented by Utah Lake, lies almost entirely within Utah Lake-Jordan River drainage basin. Most agricultural and urban development and 99.7 percent of the population of 145,000 has been concentrated in Utah Valley, the territory between the base of the Wasatch Mountains on the east and Utah Lake on the west. More than 45 percent of total land area is owned or managed by a federal, state or local governmental managed by a federal, state of local governmental agency. Control of nearly 38 percent of the land area is shared by the Forest Service and the Bureau of Land Management. This volume is concerned with background data on soils, population trends and projections of future urban trends in housing, commerce and industry. The major portion of this report is devoted to maps and inventories of water and sewer systems for individual communities plus an inventory of storm water facilities. (See also W73-14493) (Edwards-North W73-14492

WATER, SEWER AND STORM DRAIN STUDY, UTAH COUNTY, UTAH: VOLUME II, PLAN

Despain (I. Dale) and Associates, Provo, Utah.

Prepared for Utah County Council of Governments, September 1972. 228 p. 38 fig. 71 tab, ap-

Descriptors: \*Planning, \*Water supply,
\*Sewerage systems, \*Storm drains, Coordination,
Drainage systems, Water supply development,
Canyons, Utah.

Identifiers: \*Utah County (Utah), Cedar Valley (Utah), Wasatch Front Canyons (Utah), Water

Key elements are detailed individual plans for the le municipalities and other developing areas in the county, which are coordinated into one master plan. The basic goals and criteria used in formulating the plan are summarized. Evaluated are present water, sewer, and storm drain facilities, as well as a projection of future needs. Major imwell as a projection of future needs. Major improvement projects and programs, coupled with their priority rating, are listed. Primary responsibility for implementation rests with the individual municipalities, although the creation of an implementation organization within the Utah Council of governments is recommended in order to promote governments is recommended in order to promote cooperative action among municipal units. A selected summary of domestic water standards and waste water standards for the state of Utah is included. (See also W73-14492) (Hoffman-North W73-14493

AMARILLO, TEXAS: REPORT ON SANITARY SEWERAGE AND SEWAGE TREATMENT. 1967

Freese, Nichols and Endress, Fort Worth, Tex.

March, 1968. 59 p, 1 fig, 2 append.

Descriptors: \*Sewerage, \*Sewage treatment, Sewage disposal, "Interceptor sewers, "Effluents, Design criteria, Costs, Planning, Waste treatment, "Texas. Identifiers: Capital improvements, \*Amarillo

Focus is on three elements of the sanitary sewerage system, collection facilities, treatment plants, and the disposal and/or reuse of treated effluent. Each element is analyzed in terms of the fluent. Each element is analyzed in terms of the existing situation and future requirements. Improvements are recommended for each element via detailed schedules which include projected cost estimates. Recommendations include new collection facilities for urbanizing fringe areas, the expansion of the two treatment plants, and con-tinued use of treated effluent for industrial and agricultural purposes. The report is engineering oriented, emphasizing detailed projects up to 1972, and includes proposed improvements that are like ly to be needed for 5-year intervals to 1990. A discussion of population trends and design criteria provides a basis for the analysis. (Elfers-North Carolina) W73-14501

A NEW CONCEPT FOR OPERATOR WAGES. Water Pollution Control Federation, Washington. DC

J. A. Voegtle, and F. I. Vilen.

Journal Water Pollution Control Federation, Vol 45, No 2, p 203-209, 1973. 7 tab.

Descriptors: Waste water treatment, \*Compensation, \*Wages, \*Wisconsin, Analysis, \*Cost analy-

Identifiers: \*Waste water treatment operators, Comparative wage analysis.

In order to estimate the fair compensation to a wastewater system operator a pilot study was performed with the aid of a questionnaire distributed at the Wisconsin Wastewater Operators Con-ference. Ten work functions were derived from data recording operator time spent in 25 different work categories for an uninterrupted six-week period. In addition, general information concerning operator credentials, experience, and responsibilities were gathered by the survey. Wage information applicable to the various work categories was gathered from the Wisconsin State Employment Service. Analysis indicates that operator wage rates are less than the total of the current wage rates are less than the total of the current rates for work in occupations corresponding to the work categories multiplied by the percentage of time spent in performing similar duties. The indi-cation is that the operator is receiving a wage due to a man with a variety of diluted skills as represented by the work categories. One cause of this might be the application of the title 'operator' to all levels of experience and combinations of

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technical skills. More specifically descriptive job titles are recommended. (Weaver-Wisconsin) W73-14511

PRICETAG TO INDUSTRY, Hazen and Sawyer, New York. C.R. Walter. Water and Wastes Engineering, Vol 10, No 1, p A13-A14, 1973.

Descriptors: \*Industrial wastes, \*Waste water treatment, \*Use rates, Pricing, Sewage treatment, \*Pollution taxes (Charges). Identifiers: Flow charges, Surcharges, Municipal sewage systems, Waste strength.

Methods for determining fees for the treatment of industrial wastes discharged into municipal sewerage systems are discussed. Total revenues needed to support the municipal sewerage utility are calculated from all costs associated with the operation, maintenance and management of the system and treatment facilities; sewerage service charges are based on these costs which are allocated against users and properties in proportion to the benefits received. Various types of charges are levied, however the most common fee is based to the benefits received. Various types of charges are levied, however the most common fee is based upon the volume of flow contributed to the system with a possible supplemental surcharge for treatment of exceptionally strong wastes. Although such surcharges are theoretically appealing they are often politically intractable as well as difficult and costly to establish. If combinations of flow charges and strength surcharges are adopted, plant expenses should be allocated to three cost-of-service components--volume costs, strength costs, and customer costs. Using this accounting scheme, the most equitable schedule of charges may be calculated. For the benefit of the local economy, industry located outside municipal boundaries should be served. Long-term contracts between cities and industries protect the city's financial stability. (Weaver-Wisconsin) W73-14518

DES MOINES METROPOLITAN SANITARY SEWERAGE SYSTEM STUDY: PART B-MAIN SEWAGE TREATMENT PLANT. Veenstra and Kimm, West Des Moines, Iowa. For primary bibliographic entry see Field 06A. W73-14529

COMPREHENSIVE WATER AND SEWER PLAN: FREDERICK COUNTY, MARYLAND, VOLUME I.

Beavin Co., Baltimore, Md. For primary bibliographic entry see Field 06A. W73-14530

METROPOLITAN COMPREHENSIVE WATER. SEWAGE, AND SOLID WASTE PLANNING: VOLUME I-BACKGROUND.

Bi-State Metropolitan Planning Commission, Rock

For primary bibliographic entry see Field 06A. W73-14531

METROPOLITAN COMPREHENSIVE WATER, SEWAGE, AND SOLID WASTE PLANNING STUDY: VOLUME II-INVENTORY ANALYSIS AND PLAN.

Bi-State Metropolitan Planning Commission, Rock Island, Ill.

For primar W73-14532 ary bibliographic entry see Field 06A.

METROPOLITAN COMPREHENSIVE WATER, SEWAGE, AND SOLID WASTE PLANNING STUDY: VOLUME III-SHORT-RANGE DEVELOPMENT PROGRAM. Bi-State Metropolitan Planning Commission, Rock

Island, Ill.

For primary bibliographic entry see Field 06A. W73-14533

REPORT ON SANITARY SEWERS IN KANSAS CITY, KANSAS, 1973, Kansas City Engineering Dept., Kans. G. C. Clark. 1973. 45 P, 1 FIG.

Descriptors: \*Separated sewers, \*Sewerage, \*Construction, Kansas, Forecasting, Sewers, City planning, Programs, Project planning, Planning, Identifiers: \*Kansas City (Kansas), \*Sanitary

Expected growth in Kansas City, Kansas will Expected growth in Kansas City, Kansas will require additional sewers and sewage treatment. In 1970, the City occupied an area of 58.5 acres, while at the end of 1972 it covered 109 square miles. Although a large portion of this area is currently undeveloped, the construction of an interstate highway is expected to cause rapid growth. The city is divided by a ridgline, creating a necessity for two sewer systems and two additional treatment plants; one on the Missouri River (to the south), and the other on the Kansas River. A master plan for the construction of the two plants and 40 miles of trunk sewers is presented. Forty-five projects are listed to provide sewers and sewage treatment plants. Cost is put at \$27,170,440, of which federal and state grants should cover all but \$6,435,143 for the 3-year program. (Poertner) W73-14535

COMPREHENSIVE WATER AND WASTE-WATER PLAN, 1969. Baltimore City Dept. of Public Works, Md. Bureau of Engineering.
For primary bibliographic entry see Field 06A.
W73-14538

REGIONAL WASTEWATER FACILITIES FOR THE METROPOLITAN AREA, REPORT ON TREATMENT FREDERICK THE AREA, FREDERICK COUNTY, MARYLAND. Baker-Wibberley and Associate Baker-Wibberley Hagerstown, Md Associates. For primary bibliographic entry see Field 06A. W73-14541

EFFECT OF WASTE WATER FROM THE ASTRAKHAN' CELLULOSE AND PASTEBOARD COMBINE ON SOIL PROPERTIES (VLIYANIYE STOCKNYKH VOD ASTRAK-(VLITANTE STOCHNIN VOD ASTRAA-HANSKOGO TSELLYULOZNO-KARTONNOGO KOMBINATA NA SVOYSTVA POCHV), V. S. Shumakov, and M. P. Popova. Pochvovedeniye, No 10, p 99-109, October 1972. 2

fig, 12 tab, 14 ref.

Descriptors: \*Water reuse, \*Return flow, Furrow rigation, \*Irrigation effects, 'Soil properties, Pulp and paper industry, \*Pulp wastes, Domestic water, Industrial water, Irrigation water, Salinity, Salts, Leaching, Alkalinity, Permeability, Model

Identifiers: USSR, Poplar trees, Solonetzization, Astrakhan SSR.

Waste water from pulp and paper industries can-not be discharged into natural bodies of water without preliminary treatment. The use of a mixture of domestic and industrial waste water from the Astrakhan' Cellulose and Pasteboard Combine to irrigate stands of specially bred, rapidly growing poplar on Brown Desert-Steppe soils resulted in partial desalinization of saline soils in the first few years, while more rapid desalinization occurred when the same soils were irrigated with Volga water. Desalinization of variously textured Brown Desert-Steppe soils after irrigation with domestic waste water resulted in a 33% to 92% increase in total alkalinity and in the appearance of or increase in alkalinity from normal carbonates, as well as in a 5% to 16% increase in the degree of soil solonetzicity. The rate of soil solonetzization va-ries with soil texture and rates of irrigation-water application and absorption. Solonetzization in soil surface layers of irrigated furrows caused a sharp decrease in permeability (by a factor of 1.3 to 1.5). Occurrence of solonetzization in soils irrigated with domestic waste water was confirmed in a model experiment. To improve absorption of irrigation water by poplar, temporary furrows should be used. (Josefson-USGS) W73-14601

EFFECTS OF TREES AND FORESTS IN NEUTRALIZING WASTE, Pennsylvania State Univ., University Park. School

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of Forest Resources.

W. E. Sopper.

Trees and Forests in an Urbanizing Environment,
March 1971, 15 p, 3 fig, 15 tab, 48 ref. Pennsylvania Institute for Research on Land and Water
Resources, Reprint Series No. 23. OWRR B-020-PA (11).

Descriptors: \*Waste water disposal, \*Irrigation, \*Municipal wastes, \*Water reuse, \*Forests, Nitrogen, Phosphorus, Nitrates, Performace, Groundwater recharge, Trees, Growth rates, Industrial wastes, Water conservation. Identifiers: \*Site conditions.

The living-filter system for renovation and conservation of municipal waste water is feasible wherever you have the following site conditions: (1) Soil with an infiltration and percolation capacity sufficient to accommodate applications of waste water at the commodate applications of waste water at recommended rates. Soil permeability must be high enough to permit drainage of the renovated effluent and to maintain aerobic soil conditions. In this respect, forests are particularly suitable, since most forest soils are very porous and have higher infiltration and percolation rates than tilled agricultural land. In addition, most forest soils remain porous during the winter season. (2) Soil with sufficient chemical-adsorptive capacity, water-retentive capacity, and depth to the groundwater table to temporarily retain dissolved minerals for use by the vegetative cover and microorganisms and thus prevent groundwater contamination. (3) Low relief with a vegetative cover and a protective accumulation of surface or-ganic matter to prevent and minimize surface runoff, particularly during the winter months. (4) A groundwater aquifer with a fairly deep water table to accommodate subsequent changes in ground-water storage, and with sufficient horizontal permeability to allow for adequate lateral displace-ment of the renovated waste water. (Calwardi-W73-14610

SPRAY IRRIGATION OF SEWAGE EFFLUENT AND SLUDGE

Pennsylvania State Univ., University Park. School

of Forest Resources.
W.E. Sopper.
In: Proceedings, First National Conference on Composting-Waste Recycling, Rodale Press, Emmars, Pennsylvania, September 1971, p 65-78, 17 tab, 13 ref. Pennsylvania Institute for Research on Land and Water Resources Reprint Series No 27. OWRR B-020-PA (12).

Descriptors: \*Waste water disposal, \*Irrigation, \*Municipal wastes, \*Water reuse, \*Forests, Nitrogen, Phosphorus, Nitrates, Performance, Groundwater recharge, Trees, Grasses, Legumes, Growth rate, Water conservation, Revegetation. Identifiers: Acid mine spoil banks, \*Spray irriga-

Eight years of research have indicated that the living filter system for renovation and conservation of municipal waste water is feasible and that com-

#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Waste Treatment Processes—Group 5D

binations of agronomic and forested areas provide the greatest flexibility in operation. Such a system is more adaptable to small cities and suburbs than to large metropolitan areas because of the availability of open land close to the waste water treatment plant, although the land area requirement is not a major prohibitive factor. At the recommended level of irrigation, 2 inches per week, only 129 acres of land would be required to dispose of I million gallons of waste water per day. Although large contiguous blocks of agricultural and natural forest land would be the most desirable for efficiency and economy, major metropolitan areas could utilize golf courses, playing fields, forest preserves and parks, greenbelts, scenic parkways, and perhaps even divided highway and beltway medial strips. Preliminary results after two years binations of agronomic and forested areas provide and pernaps even divided nignway and bettway medial strips. Preliminary results after two years of research also indicate that municipal waste waters might also be used to reclaim and revegetate many of the barren bituminous stripmined spoil banks existing throughout the Appealable regions are the results. palachian region and restore them to a more esthetic and productive state. (Galwardi-Texas)

A SYSTEMS APPROACH TO SOLID WASTE MANAGEMENT IN ASIA: BANGKOK, THAI-LAND, AS A CASE STUDY, Asian Inst. of Tech., Bangkok (Thailand). Dept. of

Environmental Engineering. R. J. Frankel, and E. A. R. Ouano.

In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by Interna-tional Federation of Automatic Control and the Intonal rederation of Automate Control and the in-ternational Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 247-253, 1973. 5 fig, 1 tab, 3 ref.

Descriptors: \*Solid wastes, \*Management, \*Evaluation, \*Systems analysis, Simulation analysis, Linear programming, Optimization, Waste disposal. Waste treatment, Economics, Mathematical models.
Identifiers: \*Thailand (Bangkok), Asia, Waste col-

lection, Cost sensitivity.

A study which presents a systems approach for A study which presents a systems approach for handling solid waste porblems in the Asian environment, using Bangkok as a case study is reported. The systems approach accounts for the interdisciplinary nature of solid waste management and permits for systematically dividing the problem into specialized sub-problems which can problem into specialized sub-problems which can be handled by more comprehensive techniques. In this study, variables and parameters that affect the effectiveness of solid wastes collection, treatment and disposal in Bangkok were analyzed. A field study was conducted to measure the values of the collection system, to quantify the stochastic nature of the parameters, and to determine the efficiency of present crew utilization. A computer simulation model was developed to quantify the interactions of variables in the collection system. The model was verified using current operation data. A sensitivity analysis using variations in crew size, truck volume, type of container and al-ternative means of disposal was performed using the simulation model. Linear programming techniques were employed to determine the least cost alternative or optimum combination of alternatives regarding choice of site for facilities for treatment and disposal. Recommendations for imtreatment and disposal. Recommendations for improving the present system were made given the social and economic constraints existing in Bangkok. Comparison of the solid waste management practices in Bangkok, Manila, and Hong Kong was made to extend the usefulness of the developed methodology to other Asian cities. (Bell-Cornell) W73-14674

ZERO DISCHARGE - THE ULTIMATE IN WATER CONSERVATION, Battelle Inst., Geneva (Switzerland). Chemical and Environmental Engineering Systems Div. J. C. Shorrock, and M. G. Royston.

British Water Supply No. 3, p 12-16, March 1973. 1

Descriptors: \*Recycling, \*Waste water treatment, Water treatment, Fermentation, \*Water reuse, \*Water conservation. Identifiers: \*Zero discharge, Residuals manage-

Zero discharge refers to a goal for water-use systems in which all wastes are resources which can be used. It is based on a concept of finite resources. It is recommended that all bodies using water should develop a conceptual zero-discharge strategy and use this as a long-range planning tool for fixing realistic targets, planning future systems, and for the allocation of priorities to research and development objectives. The alterna tive approach is seen as playing a passive role, waiting to be forced into taking action by authori-ties. Steps in establishing a zero-discharge strategy ties. Steps in establishing a certo-uschange strang, are (1) inventorying water consumption item by item and listing positive means to be adopted to limit consumption to minimum levels required by each process stage, (2) defining qualities of water required, and (3) establishing treatment levels for recycle of water. Systems for upgrading dissolved collisions are formerations association and pollutants are fermentation, evaporation and distillation, reverse osmosis, chemical precipitation, filtration and decantation, and electrochemi-cal processes. (Stein-North Carolina) W73-14684

ENVIRONMENTAL PROTECTION: NEW NAVY

A. J. Ogrinz, III.

Environmental Science and Technology, Vol 7, No 1, p 26-29, January 1973. 2 fig.

Descriptors: \*Ships, \*Harbors, \*Sewage treat-ment, \*Oil spills, Radioactivity, Water pollution control, Submarines, \*Pollution abatement, Waste

Identifiers: Shipboard wastes, Holding tanks, Recirculating flush systems.

Importance of environmental planning has been officially recognized by the U.S. Navy by creation of an Environmental Protection Division, awards for outstanding performance in protection of the environment and initiation of a series of studies in pollution control research. An electro-mechanical pollution control research. An electro-mechanical incinerator system to treat shipboard sewage has been developed by Fairbanks-Morse Research Center, Pittsburgh. Also holding systems and recirculating flush systems have been studied with holding tanks favored by preliminary evaluation. A prototype sewage disposal system on submarine tender Fulton has 3 parts: (1) on-board sewage teatment plant collects and incinerates the Fulton's sewage, (2) all other wastes are collected by internal manifold and transferred ashore, (3) a third system transfers sewage from submarines which come alongside for repair. Lack of radioac-tivity above normal background levels in harbors where naval nuclear-powered ships are based in-dicates no additional plans or procedures necessadicates no additional plans or procedures necessa-ry. A mandatory design change which reroutes storage tank overflow lines in ships to a series of tanks equipped with an overflow alarm may reduce the number of oil spills per refueling. Long range goals envision all wastes-sewage, oil, solids, etc. disposed of ashore when in port thus halting dischanges of oil into ocean water. Navy's halting discharges of oil into ocean water. Navy's environmental program funding has been virtually without opposition. Benefits of an effective environmental program are: (1) cleaner environment (2) improved international image for U. S., (3) better cooperation with private industry for cleaner harbors. (Stein-North Carolina) W73-14689

WASTE TREATMENT SYSTEM,

U. S. Patent No. 3,749,243, 4 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 912, No 5, p 1807, July 31, 1973.

Descriptors: \*Patents, \*Waste water treatment, Equipment, \*Aeration, Pollution abatement, Water quality control, Water pollution control.

Dual clarifiers selectively receive an inflow of effluent, through the operation of a switch gate, from a pressure tank where the effluent is mixed with air and certain chemicals. The clarifiers incor-porate upper and lower skimming and sludge removal raking apparatus. The rakes remove the solids to discharge flow lines entering a central sludge reservoir. The remaining liquid moves through flow lines into a vertical aerator tank through flow lines into a vertical aerator tank where it is subjected to pressure aeration. The air is dispersed through the liquid effluent and partially dissolved with the subsequent passage of the effluent to one of the clarifiers. The system is to incorporate automatic controls which include a limit with accounted to the limit of the third tank of the clarifiers. limit switch mounted on the lip of the skimmer trough associated with each clarifier. The switches sense the attainment of a specific effluent level and are automatically activated to divert inflowing effluent to the proper clarifier. Flow from clarifier to aerator is also automatically regulated. (Sinha-W73-14691

SACRIFICIAL ELECTRODE SYSTEM FOR REMOVAL OF HEAVY METAL IONS FROM WASTE WATER, Nalco Chemical Co., Chicago, Ill. (assignee)

E. E. Johnson, R. N. Buggs, and R. L. Kornmann. U. S. Patent No. 3,748,240, 2 p, 4 ref; Official Gazette of the United States Patent Office, Vol 912, No. 4, p. 1523, July 24, 1973.

Descriptors: \*Patents, \*Waste water treatment, Metals, Electrodes, Cathodes, \*Electrolysis, \*Ions, \*Heavy metals, Pollution abatement, Water pollution control, Water quality control, \*Mercury (Metal), Silver, Lead, Cadmium, Copper. Identifiers: Acid, Insoluble sulfides.

A method and an electrode cell system are discussed for the removal of certain heavy metal ions in solution especially from waste water. The process consists of precipitating the ions at a pH below 7 as an acid insoluble sulfide. The ions are electrolized in a carbon/carbon electrode cell system. The sacrificial cathode contains 20-80% cathode weight of elemental sulfur. Six examples are presented. The system is particularly applica-ble to the removal of mercury ions to form mercu-ry sulfide and mercury bisulfide. It is also applica-ble to heavy metals ions such as silver, lead, cadmium, and copper. These can form acid insolube sulfides which then can be centrifuged or filtered and removed from the system. (Sinha-OEIS) W73-14693

BATCH SEWAGE TREATMENT SYSTEM AND METHOD, BioPure, Inc., Tualatin, Oreg. (assignee)

U. S. Patent No. 3,746,638, 6 p. 3 fig. 8 ref; Official Gazette of the United States Patent Office, Vol912, No 3, p 1057, July 17, 1973.

Descriptors: \*Patents, \*Sewage treatment, \*Waste water treatment, Equipment, \*Aerobic treatment, Pollution abatement, Water quality control, Water pollution control, Aeration.

Incoming sewage is mixed and aerated continu-ously (or intermittently under low flow conditions) and withdrawn in batches for clarification and and withdrawn in batches for clarification and discharge. A basket having open mesh side and bottom walls is partly submerged in the mixed aerated sewage. A portion of the aerated mixed liquor is circulated through the basket to cause aerobic digestion and hydraulic erosion. Batches

#### Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# **Group 5D—Waste Treatment Processes**

of mixed liquor are intermittently pumped into a settling chamber in excess of the amount filling the settling chamber. The excess is discharged back into the aeration chamber over a weir and acts to skim floating sludge back into the aeration chamber. The resulting batch thus withdrawn from the aeration chamber is settled in the settling the aeration chamber is settled in the settling chamber under quiescent conditions. A part of the settled batch, specifically supernatant liquor taken from below the top scum layer, is then delivered to a discharge chamber. It is further settled and the resulting supernatant liquor discharged. Settled sludge and floating scum from the settling and discharge chambers are returned to the aeration chamber by pumps which completely empty these chambers. (Sinha-OEIS)
W73-14694

SIMPLE WATER TREATING APPARATUS, Kurita Water Industries Ltd., Osaka (Japan). (assignee) For primary bibliographic entry see Field 05F. W73-14695

SELECTIVE MULTI-STAGE FILTRATION SYSTEM, R. Nebolsine, and G. San Roman

U. S. Patent No. 3,746,172, 3 p, 2 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 912, No 3, p 944, July 17, 1973.

Descriptors: \*Patents. \*Waste water treatment. Filtration, \*Oil water, \*Oil pollu-tion, Equipment, Pollution abatement, Water pol-lution control, Water quality control.

This filtration system consists of inter-connected filter units, each being adapted to use one or more filter media and operated at its own rate and also having its own back-wash cycle. In the treatment oily waste water or other fluid enters an initial unit referred to as an oil separator. An interceptor is connected to an oil outflow pipe for removal of oil for storage. The interceptor also has a discharge pipe at its base for passage of sludge to discharge tank. (Sinha-OEIS) W73-14696

SLUDGE SEPARATION SYSTEMS EMPLOY-ING REFRIGERATION MEANS,

Carrier Corp., Syracuse, N.Y. (assignee) F. B. Neyhart, and J. S. Styron. U. S. Patent No. 3,745,782, 5 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 912, No 3, p 847, July 17, 1973.

Descriptors: \*Waste water treatment. \*Patents. \*Water treatment, Potable water, Water quality control, Freezing, Condensation, \*Heat exchangers, \*Refrigeration, \*Sludge treatment, Separation techniques.
Identifiers: Alum.

An apparatus for promoting separation of the solid and liquid constituents of a sludge is provided with a pair of identical falling film heat exchangers which alternately serve as a refrigerant evaporator and refrigerant condenser. The refrigeration system is provided to freeze sludge in one heat exchanger by examparities the refrigerant on the exchanger by evaporating the refrigerant on the extension of the heat exchange tubes. The evaporated refrigerant is compressed and condensed on the exterior of the tubes in the other heat exchanger. Recirculation for sludge is provided to continuously cool and solidify a thin film of the sludge descending in the heat exchange tube of one heat exchanger and a similar recirculation is provided for recirculating cooling medium. The refrigeration system is systematically reversed, using the cooling capacity of the frozen sludge in the heat exchange tubes of one of the heat exchangers to condense refrigerant while freezing sludge. (Sinha-OEIS) W73-14697

MARINE SEWAGE COLLECTION AND DISCHARGE SYSTEMS, MARINE

K. F. Kennedy.
U.S. Patent No 3,703,960, 4 p, 7 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 904, No 4, p 518, November 18, 1972.

Descriptors: \*Waste water treatment, \*Patents, \*Sewage treatment, Treatment facilities, Boats, \*Domestic wastes, \*Sewage disposal, Pollution abatement, Water pollution control, Water quality Identifiers: Waterfront facilities.

Sewage at waterfront facilities where houseboats. boats and ships are moored and/or stop for service is collected in a system supported by the facilities such as docks and floats and then pumped into a shore system. The system is designed to be snore system. The system is designed to be responsive to water motions caused by watercraft, wind, waves, and tides. The partially submerged collection tanks are often comprised of multiple sections of sewer pipes sealed together and then capped at the remaining open ends. Sewage from the waterfront facilities is directed through flexible couplings and collection pipes, arranged on grade, into partially submerged holding tanks. Each tank is equipped with pumping apparatus to periodically discharge sewage into pipes leading to a sewage system ashore. (Sinha-OEIS) W73-14701

IMPROVED CROSS-FLOW FILTRATION PROCESS FOR REMOVAL OF TOTAL ORGANIC CARBON AND PHOSPHATES FROM AQUEOUS SEWAGE EFFLUENTS, K. A. Kraus, and H. A. Mahlman.
U. S. Patent Application Serial No 200,840 (70), November 22, 1971. 14 p, 3 fig, 5 tab.

Descriptors: \*Patents, \*Waste water treatment, Filtration, Water pollution control, \*Sewage treatment, \*Organic compounds, \*Phosphates, Pollution abatement, Water pollution control.

A cross-flow filtration process is described for the A cross-flow intention process is described for the removal of total organic and phosphate content of aqueous sewage effluents. An additive selected from powered carbon, a salt of hydrous metal ox-ide, or the hydrous oxide is included in an aqueous feed sewage in small but effective amounts. The mixture is pumped through a filter unit of the internal or external flow-through type at a pressure and velocity sufficient to effect cross-flow filtration. Typical presures used experimentally were in the range 3 to 100 psi and cross-flow velocity in the range 2 to 30 ft/sec. Several modes of cross-flow filtration are set forth. The filtering medium com-prises a porous substrate material having pores of from 5 to as much as 200 microns in size aided by an inert filter aid material deposited on the feed side of the substrate material. The substrate material may comprise flexible, pressure-resistant fire hose jacket for example, made from polyester warp with nylon filler; stainless steel or other screening; nylon, polyester or other synthetic screens; and porous ceramic or carbon. The filter aid may be selected from such material as diatomaceous earth, perlite, asbestos fiber, cel-lulose fiber, silica gel, and carbon fiber or powder. Six examples and test results are given. (Sinha-OFIS) W73-14702

**EVALUATION OF TREATMENT FOR URBAN** WASTEWATER REUSE, Colorado Univ., Boulder. Dept. of Civil and En-

vironmental Engineering. K. D. Linstedt, and E. R. Bennett.

K. D. Linstedt, and E. K. Bennett. Available from GPO, Washington, DC 20402 as EPI.23/2:73-122 - Price \$2.10; microfiche from NTIS as PB-723 726 \$1.45. Environmental Protec-tion Agency, Environmental Protection Technolo-gy Series, Report EPA-R2-73-122, July 1973. 139 p, 73 fig, 8 tab, 51 ref. EPA Project 17080 DOI.

Descriptors: \*Sewage treatment, \*Waste water treatment, \*Water reuse, Model studies, Methodology, Water conservation, Water pollution control, Water utilization, Recirculated water, Industrial water, Reclaimed water, Treatment

The efficacy of combining biological nitrification with each of two modes of chemical clarification is evaluated for production of a water suitable for specific industrial reuse applications. A 7200 gpd pilot plant was constructed, operated and analyzed. In the conventional clarification system, low doses of lime or alum were effective in removing greater than 95% of the BOD, turbidity, and ing greater than 95% of the BOD, turbolly, and suspended solids from the nitrified secondary ef-fluent. Efficient phosphorus removals neces-sitated higher lime and alum additions of 300 mg/liter, and 100-150 mg/liter, respectively. At the higher lime doses, a two-fold reduction in bacterial organisms was achieved. Specific heavy metals were removed through both alum and lime addi-tions. With either coagulant chemical, practical rapid sand filter runs of 16 hours were possible. Similar removal results were obtained with alum in a high-rate clarification flow system with direct dual-media filtration of alum flocculated wastewater. Filter runs of 5-6 hours could be realized. (Woodard-USGS) W73-14750

#### 5E. Ultimate Disposal of Wastes

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SLUDGE PROCESSING FOR COMBINED PHYSICAL-CHEMICAL-BIOLOGICAL SLUDGES

Brown and Caldwell, Inc., San Francisco, Calif. For primary bibliographic entry see Field 05D. W73-14218

ULTIMATE MANAGEMENT OF RADIOAC-TIVE LIQUID WASTES, Idaho Nuclear Corp., Idaho Falls.

For primary bibliographic entry see Field 05G. W73-14390

SEWAGE EFFLUENT AND SLUDGE MAKE POSSIBLE REVEGETATION OF STRIP MINE

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. W. E. Sopper, and L. T. Kardos.

Science in Agriculture, Vol 18, No 3, p 10-11, Spring 1972, 1 fig, (Pennsylvania Institute for Research on Land and Water Resources Miscellaneous Technical Report, 1971). OWRR B-020-PA (9).

Descriptors: \*Sewage effluents, \*Sewage disposal, \*Sludge disposal, \*Water reuse, Irrigation, \*Strip mine wastes, Revegetation, Tress, Grasses, Legumes, Hydrogen ion concentration, Temperatures, Soil moisture, Pennsylvania, Nitrogen, Phosphorus, Toxicity, Salts. Identifiers: Strip mine spoil banks, Toxic chemi-

Irrigation of coal strip-mine spoil material with municipal sewage effluent and liquid digested sludge has produced dramatic results in survival and growth of tree seedlings and growth of grass and legume cover. Results indicate that these harsh sites devoid of vegetation for decades can be improved and revegetated by irrigation with wastes from municipal sewage effluent plants. Since treated sewage effluent had produced significant crop yields and tree growth, the decision was made to try the same technique on reclaiming barren waste land. Effects of the irrigation treatments on certain chemical attributes of the soil solution in the spoil were examined by sampling the percolate which passed through the 3.5 foot depth of spoil, using lysimeters installed in the

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Water Treatment and Quality Alteration—Group 5F

sand layer below the spoil. Potential toxicity of a spoil is best characterized by the pH. Average pH of the percolate obtained from natural rain during the months prior to the irrigation treatment ranged between 2.2 and 2.8, indicating severely toxic acidic conditions. Over the 24-week irrigation acidic conditions. Over the 24-week irrigation period the average pH was relatively unchanged except for the treatment using 2 inches each of effluent and sludge per week, where the pH increased significantly to 4.06. This is also the treatment which had the greatest dry matter production of grasses and legumes and the best height growth of tree seedlings. (Gelwardi-Texas)

REVEGETATION OF STRIP MINE SPOIL BANKS WITH SEWAGE EFFLUENT AND SLUDGE,

SLUDGE, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. W. E. Sopper, and L. T. Kardos. Clover Leaves, Vol 12, p 14-16, May 1971. OWRR

B-020-PA (13),

Descriptors: \*Sewage effluents, \*Sewage disposal, \*Sludge disposal, \*Irrigation, Strip mine wastes, Revegetation, Trees, Grasses, Legumes, Hydrogen ion concentration, Temperature, Soil moisture, Pennsylvania, Nitrogen, Phosphorus, Toxicity, Salts.

Identifiers: Strip mine spoil banks, Toxic chemi-

Spoil material was obtained from a bank over the Lower Kittanning bituminous coal seam in Clearfield County, Pennsylvania. This bank was selected because it has remained barren for 23 selected because it has remained barren for 23 years despite repeated attempts at revegetation and is extremely acid (pH 2.0 to 3.0). Ten boxes were filled with 3 1/2 feet of spoil material in the fall of 1968, allowed to consolidate over the winter and refilled to capacity in the spring of 1969. In April 1969 each box was planted with seven spe-cies of tree seedlings—Japanese larch, white spruce, Norway spruce, white pine, European alder, hybrid poplar, and black locust. In addition, 2 species of grass (orchard grass and tall fescue) and 2 species of legumes (crown vetch and bird-sfoot trefoil) were broadcast seeded in each box. Two of the boxes were untreated and maintained as controls. The remaining eight boxes were di-vided into four groups of two boxes for varying degrees of treatment. Treatments were very effecdegrees of treatment. Treatments were very effective in establishing a ground cover of grasses and legumes. Growth response of each species was measured in terms of pounds of dry matter produced per acre and percentage of ground cover. Best germination and growth was obtained with the treatment, 2 inches of effluent and 2 inches of sludge per week, (2E+2S). Orchard grass and tall fescue had the highest dry matter yields of 3237 and 2646 pounds per acre, respectively. It was quite apparent from the results that sludge was a necessary percentuisite to the tively. It was quite apparent from the results that sludge was a necessary perequisite to the establishment of grasses and legumes from seed. The organic residue in the sludge provides the necessary additional detoxifying action to permit the germinated grasses and legumes to survive and grow. The percentage cover of the spoil material by the grasses and legumes on the irrigated treatments ranged from 28 to 100% for orchard grass, 5 to 91% for tall fescue, 3 to 56% for birdsfoot trefoil, and 2 to 58% for crown vetch. (Galwardi-Texas) Texas) W73-14613

#### 5F. Water Treatment and **Quality Alteration**

SLUDGE CONDITIONING USING SO2 AND SLUBGE CONDITIONING USING SOZ AND LOW PRESSURE FOR PRODUCTION OF OR-GANIC FEED CONCENTRATE, Snell (Foster D.), Inc., Florham Park, N.J. For primary bibliographic entry see Field 05D. W73-14222 CITY OF ESCONDIDO AND VISTA IRRIGA-TION DISTRICT FEASIBILITY STUDY OF JOINT FILTRATION PROGRAM. Montgomery (James M.), Inc., La Jolla, Calif.

December, 1971. 25 p, 3 fig, 2 plates, 21 tab, 1 ap-

Descriptors: "Water supply, "Water treatment, "Filtration, Costs, Joint costs, Water requirements, "California.

Identifiers: Joint treatment plant, Escondido (Calif), Vista Irrigation District (Calif), Lake Henshaw (Calif).

The northern part of San Diego County has ex-perienced a rapid increase in population during the past decade coupled with a significant trend away from agricultural use of land toward use for hous-ing and commercial purposes. As this trend con-tinues public demand for water of a higher quality increases. Water for both the Vista Irrigation Dis-trict and the City of Escondido is obtained from the Colorado River and Lake Henshaw. Except for clorination and some addition of alum to for clorination and some addition of aium to reduce turbidity, neither of these two sources are now provided with treatment of any sort. The basic finding of this study is that it would be economically desirable for the City of Escondido and the Vista Irrigation District to construct a joint and the Vista Irrigation District to construct a joint water treatment plant designed to meet initial needs through 1990, to be enlarged as future requirements dictate. Several alternative plans for the size and operation of such a plant are analyzed, particularly in terms of costs. The recommended plant size of 50 mgd would significantly reduce operation and maintenance costs as compared to two individual plants. Detailed cost data, analyses of water requirements for Escondido and the Vista Irrigation District, a discussion data, analyses of water requirements for Escondido and the Vista Irrigation District, a discussion of the water treatment process, plus a site plan and map of the proposed plan are included. (Elfers-North Carolina) W73-14240

REVERSE OSMOSIS FOR WASH WATER

RECOVERY, Envirogenics Systems Co., El Monte, Calif. For primary bibliographic entry see Field 05D. W73-14387

INFLUENCE OF SURFACE OXIDES ON AD-SORPTION AND CATALYSIS WITH AC-TIVATED CARBON, Maryland Univ., College Park. Dept. of Civil En-

For primary bibliographic entry see Field 05D.

KINETICS OF VIRAL INACTIVATION BY

BROMINE, North Carolina Univ., Chapel Hill. Dept. of En-

North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. G. Taylor, and J. D. Johnson.
Available from ASC-Div of Water, Air and Waste Chem., Publications Manager, Mellon Inst., 4400.
In: Preprints of Papers Presented at 165th National Meeting of American Chemical Society, April 8-13, 1973, Dallas, Tex: American Chemical Society, Division of Water, Air and Waste Chemistry, Vol 13, No 1, Paper 61, p 56-61, 1973. 4 fig, 11 ref.

Descriptors: \*Bromine, \*Bromides, \*Disinfection, \*Viruses, Treatment, \*Water treatment, Swimming pools, \*Waste water treatment.

Bromine was studied as an alternative to chlorine in the disinfection of water and wastewater. Although combined chemical species are produced when water containing organic amines or ammonia are treated with either chlorine or bromine, chloramines are ineffective as disinfectants for cysts, bacteria and viruses. Any nitrogen compounds in chlorinated waters, therefore, produce a net loss of the free chlorine species necessary for disinfection. Bromine, on the other hand, is available for the disinfection of bacteria and viruses whether it exists as free, mono or dibromamize. In addition, bromine has other characteristics which make it desirable as a disinfectant for swimming and water. Even hick openentations of bromine make it desirable as a disinfectant for swimming pool waters. Even high concentrations of bromine lack the problems of eye irritation and odor commonly found in chlorinated swimming pools. Bromine chloride is available as a gas at low pressure rather than as a liquid, and therefore promises to be easier to dose than liquid bromine. Moreover, since HOBr is only ionized 6% at pH 7.5 (versus 50% HOCL) only about one-half the amount is required to achieve the same concentration of active halogen at pH 7.5. (Knapp-USGS) W73-14395 W73-14395

A RATIONALE FOR THE REGIONALIZATION

OF PUBLIC WATER SYSTEMS, Environmental Protection Agency, Washington, D.C. Div. of Water Supply. For primary bibliographic entry see Field 06B. W73-14515

WELLESLEY -- A CASE STUDY OF THE WATER RESOURCE PROBLEMS OF A GROW-ING SUBURBAN MUNICIPALITY, Boston Univ., Mass. Dept. of Hydrogeology. For primary bibliographic entry see Field 06A. W73-14534

SIMPLE WATER TREATING APPARATUS, Kurita Water Industries Ltd., Osaka (Japan). (assignee)

U. S. Patent No. 3,746,174, 3 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 912, No 3, p 945, July 17, 1973.

Descriptors: \*Patents, \*Water treatment, Equipment, Chlorine, \*Activated carbon, Organic com-pounds, Water quality control, Waste water treat-ment, Potable water. Identifiers: \*Chemical conditioners, \*Chemical

treatment, Ferric compounds.

In the apparatus water is conditioned chemically by conditioning materials enclosed in a magazine. Conditioning materials such as active carbon which adsorbs organic and ferric components in the water, and calcium sulfite pellets which eliminate residual chlorine are enclosed in the magazine of the treatment unit. Only the water treated inside the magazine is discharged at the outlet. This is accomplished by using the water pressure at the tap to prevent the flow of untreated water by-passing the magazine. The hisher the water by-passing the magazine. The higher the water pressure the greater this effect. The magazine consists of cylindrical body walls, a magazine cap and a magazine bottom. The cap and bottom each have water passages in the form of holes or slots. A screen of small mesh is applied on the inner surface of the magazine cap and bottom to prevent the enclosed water conditioning material from being carried out through the water passage. (Sinha-OEIS) W73-14695

SLUDGE SEPARATION SYSTEMS EMPLOY-ING REFRIGERATION MEANS, Carrier Corp., Syracuse, N.Y. (assignee) For primary bibliographic entry see Field 05D.

EXPERIMENTAL DATA FOR SUBSTANTIATING THE RESIDUAL CONCENTRATIONS OF CHLORINE DIOXIDE IN DRINKING WATER, Moskovskii Gosudarstvennyi Meditsinskii Institut

For primary bibliographic entry see Field 05C.

### Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group SF-Water Treatment and Quality Alteration

W73-14707

A POTABLE WATER DISPENSER. (PATENT APPLICATION, NASA CASE MFS-21115-1), National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center. (Assignee).

H. R. Cunningham.

Available from the National Technical Information Service as N72-28097. U.S. Patent Application Serial No. 266, 930. June 28, 1972, 20 p. 7 fig.

Descriptors: \*Patents, \*Potable water, Equipment, Water utilization, Water measurement, \*Jets.

Identifiers: \*Water dispensers.

A dispenser supplies precisely measured charges of potable water into food or beverage reconstitution bags used aboard spacecraft. It has a water dispensing jet at one end and a measuring stop at its opposite end. The dispenser includes a tubular body having an axially 'reciprocable' piston within it. The piston is spring-biased toward an end wall forming a closure and having a chamber intake port and a chamber ejection port. The volume of the chamber is dictated by the position assumed by the head of the piston. The extent to which the piston is displaced for expanding the chamber is dictated by the position assumed by the measuring stop. Delivery of potable water to and from the chamber is controlled by a rotary valve while final dispensing of water is controlled by a juxtaposed linear valve. (Sinha-OEIS)
W73-14734

A FLUID DISPENSER. (PATENT APPLICA-

TION, NAS.-CASE-MFS-21163-1), National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center. (Assignee).

T. A. Cook, and H. Scheibe.

Available from the National Technical Informa-tion Service as N72-28098. U.S. Patent Application Serial No 266,925, June 28, 1972. 18 p, 8 fig

Descriptors: \*Patents, Water supply, Equipment, Water utilization, \*Potable water, Water measure-ment, \*Jets.
Identifiers: \*Water dispensers.

A fluid dispenser is described for use in dispensing precisely measured quantities of potable water aboard operative spacecraft. It is confined within a housing designed to be held in a crewman's hand and is coupled with a source of potable water under pressure. The dispenser is provided with a jet which has a mouthpiece for use of the crewman. An innovation is that it has a manually operable rack and pinion drive coupling for initiating a dispensing cycle so that an accurate record of water consumed can be maintained. Mounted on the housing is the trigger unit having a thumb-actuated lever which is digitized for initiating the operation of the dispenser. The housing contains a network of fluid conducting passageways including an inlet passageway which terminates at an intake port. There is a dispensing passageway which terminates at the mouth piece of the jet. The measuring chamber is, in practice, a bore having a cylindrical configuration terminating in a base wall. The dimensions of the measuring chamber at any given instant are determined by the position then assumed by a plug relative to the longitudinal axis of the chamber. The chamber is permitted to discharge only after it has been completely filled and the thumb-actuated lever is released. This permits the crewman to properly position his lips over the mouthpiece before releasing the lever so no water will be spilled. (Sinha-OEIS)

#### 5G. Water Quality Control

A SELECTED ANNOTATED BIBLIOGRAPHY ON WATER RESOURCES OF THE STATE OF

Washington State Dept. of Ecology, Olympia. For primary bibliographic entry see Field 02E. W73-14201

A SELECTED ANNOTATED BIRLIOGRAPHY ON COLUMBIA AND SNAKE RIVERS. Washington State Dept. of Ecology, Olympia. For primary bibliographic entry see Field 02E.

PRIVATE SECTOR REACTION TO NORMAL POLITICAL INSTITUTIONAL PROCEDURES AND OUTCOMES WHEN WATER IS AN ISSUE, Clemson Univ., S.C. Dept. of Political Science. For primary bibliographic entry see Field 06E. For primary

INSTREAM AERATION TO CONTROL DIS-SOLVED SULFIDES IN SANITARY SEWERS, Jefferson Parish Dept. of Sanitation, Metairie, La. For primary bibliographic entry see Field 05D. W73-14220

AN ASSESSMENT OF AUTOMATIC SEWER

AN ASSESSMENT OF THE ASSESSMEN W73-14221

POLLUTION FROM ANIMAL FEEDLOTS, Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W73-14227

LANCASTER COUNTY, PENNSYI COMPREHENSIVE SEWERAGE PLAN. Huth Engineers, Inc., Lancaster, Pa. PENNSYLVANIA,

Prepared for Lancaster County Planning Commission, October, 1970, 103 p. 8 fig. 26 tab, 9 append.

\*Sewerage, planning, 'Pennsylvania, Regional development, Planning, Coordination, Sewage treatment, Sewage disposal, Financing, Land use, Treatment facilities

Identifiers: \*Lancaster County (Pa.), Pennsylvania Sewage Facilities Act, Sewage Facilities

Using horizon years of 1980, 1990, and 2010, this study calls for eventual formation of six regional sewerage systems and six municipal systems to serve 85% of the county's population by 2010. The remainder of the county would be served by 'package' treatment plants and on-site disposal systems. Multiple sewerage systems are to be based on drainage basins because population den-sity will be insufficient to warrant a unitary sewerage system. Lancaster County commis-sioned the study in response to the Pennsylvania Sewage Facilities Act (Act 537). Considerations in Sewage Facilities Act (Act 337). Considerations in the sewerage system planning process included population projections, local economic conditions, existing public facilities, natural resources (espe-cially soil types), agricultural land-use patterns, topography, methods of administering, financing and operating regional sewerage systems, and cur-rently proposed sewerage plans. The study recommends a regional approach to sewage collection and treatment with establishment of a Sewerage Facilities Committee to coordinate specific pro-jects. The basis for this recommendation is a brief exposition of alternative administrative and financial techniques for sewerage systems. Extensive technical data including 13 plates are in the appen-dices. (Stein-North Carolina) W73-1423

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REPORT ON MAKEUP WATER FOR THE UPPER CANYON LAKES, LUBBOCK, TEXAS. Freese, Nichols and Endress, Fort Worth, Tex.

September, 1971, 38 p. 7 fig. 9 tab, 3 append.

Descriptors: \*Water quality, \*Water quality control, \*Reclaimed water, Water treatment, Ground-water, Irrigation, Effluents, Evaluation, \*Texas. Identifiers: \*Spray irrigation, \*Lubbock (Tex).

Lubbock proposes a chain of small lakes for Ludoock proposes a chain of small lakes tor recreational non-swimming use in a dry canyon running through the city. The study identifies three alternative sources of makeup water, each of which would have to be pumped upstream approx-imately eight miles into the uppermost lake. Alternative sources are (1) groundwater from beneath farmlands now being irrigated with treated effarmlands now being irrigated with treated ef-fluent from the city's Southeast Reclamation Plant, (2) effluent from the new activated sludge unit at the Southeast Plant without intermediate use of the water for irrigation, and (3) water reclaimed by an operational-scale plant similar to a present pilot plant of Ecological Research As-sociates. Quantitative standards for water quality which would protect environmental health and aesthetics were set. Quality of water from the three sources was compared with the desired stan-dards. Groundwater from beneath the irrigated farm needed only to be aerated to replenish dissolved oxygen, while other sources would require significant additional treatment in order to meet the standards. Costs of treating water from each source to raise water quality to the desired stan-dards were calculated. It was concluded that the groundwater source would be superior to alterna-tives in terms of both water quality and economy. (Stein-North Carolina) W73-14236

WATER QUALITY MANGEMENT PLAN FOR ALAMEDA CREEK WATERSHED ABOVE NILES.

Brown and Caldwell, San Francisco, Calif.

September, 1972, 205 p. 66 fig. 58 tab, photos, 2 append.

Descriptors: \*Planning, \*Water quality, Financing, Water demand, Water supply, Wastewater disposal, Environmental effects, California. Identifiers: \*Government standards, Alameda County (Calif.), Livermore (Calif.), Pleasanton (Calif.)

A comprehensive water supply and waste water treatment and disposal plan via a total water quali-ty management approach is discussed. The study divides into three major sections: First, existing environmental characteristics and water supply and wastewater programs are reviewed. Second, water quality problems and objectives are identified. The methodology for cost estimates and economic analyses is explicated. Third, the con ceptual development and engineering and economic evaluation of alternative plans is described, together with an evaluation of the effects of each on downstream areas and benefits of improvements to the Alameda Creek watershed area, located southeast of San Francisco, California. The final recommended plan is described in terms of physical facilities, costs, staging and governmental structures and institutional frameworks required for implementation. Specifically, a staged wastewater reclamation plan emphasizing land disposal and implemented by a single Valley-wide agency is recommended. (Hoff-man-North Carolina)

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control-Group 5G

AREAWIDE COMPREHENSIVE WATER-SEWER PLAN, PART 2, PHASE 1, 1970-1995, BREVARD COUNTY, FLORIDA. Brevard Engineering Co., Cape Canaveral, Fla.

Prepared for Brevard County Board of County Commissioners, and Brevard County Planning De-partment, September, 1972. 104 p. 20 fig, 25 tab.

Descriptors: "Planning, "Water supply, "Sewerage, "Coordination, Storm drains, Urban areas, Land use, Costs, Water quality standards, Projections, "Florida. Identifiers: "Cape Kennedy Space Center, Brevard County (Fla).

The rapid rate of growth and existing levels of urban development in Brevard County, largely because of the Cape Kennedy Space Center, make because of the Lape Renneuty Space Lenter, maxiet in eccessary for county coordination and planning in the extension of water sewerage, and drainage facilities. The county is presently serving as a liaison between local governmental units. liaison between local governmental units.

Discussed are factors affecting utility extension such as population trends, urban land use patterns, urban development policies, and pollution stan-dards; alternative plans and systems; recomdards; alternative plans and systems; recom-mended treatment processes and utility systems; implementation, including a short range program; and preliminary cost estimates for the main system components. Basic recommendations include the interconnection of the three main local water supply systems and the disposal (and eventual reuse) of effluents west of the coastal ridge to con-serve water supplies. (Elfers-North Carolina) W73-14241

URBAN SYSTEMS ENGINEERING DEMON-STRATION PROGRAM. VOLUME V. CAPITAL IMPROVEMENTS PROGRAM,

IMPROVEMENTS PROGRAM, Diversified Consultants, Inc., Jackson, Miss. J. A. Elliott, R. L. Waters, and A. P. Desmarais. Available from the National Technical Informa-tion Service as PB-213 096; \$5.75 in paper copy, \$1.45 in microfiche. Prepared for the Gulf Re-gional Planning Commission, Gulfport, Mississisp-pi, 1972. 67 p, 1 fig, 2 tab, 62 ref. MS-USE-1.

Descriptors: \*Planning, \*Water supply, \*Sewerage, \*Storm drains, \*Mississippi Gulf Coast, Coasts, Implementation, Financing, Priorities, Costs.
Identifiers: \*Capital improvements, \*Mississippi
Gulf Region, Utilities extension, Council of

Key objective of this engineering-oriented program for the planning and development of water supply, sanitary sewerage, storm drainage, and solid waste disposal systems for a four county resolid waste disposal systems for a four county re-gion in Mississippi is to provide capital improve-ments which will encourage and support new growth and development. Focus is on implementa-tion of areawide urban systems problems. Three basic alternative approaches appear practical: (1) establishment of metropolitan regions to deal with massive urban systems problems, (2) massive financial incentives, and (3) direct federal assumption of metropolitan responsibilities. The regional authority should be responsive to local interests and needs with specific functions well defined in and needs with specific functions well defined in its statutes. General implementation procedures such as public hearings, adaptation of plans, review of independent planning activities and establishment of priorities, and creation of a cen-tral billing office for handling water and disposal of solid waste charges are discussed. Specific pro-jects are described including timing of their imple-mentation, and cost estimates. (Elfers-North Carolina) W73-14242

MICROBIOLOGY OF WASTE TREATMENT, Pennsylvania State Univ., University Park. For primary bibliographic entry see Field 05D. W73-14261

REDUCTION AND EVALUATION OF BIOLOG-ICAL DATA,
Environmental Protection Agency, Ada, Okla, Of-

Environmental Protection Agency, Ada, Okla. fice of Technical Programs. For primary bibliographic entry see Field 05A. W73-14310

RESEARCH AND DEVELOPMENT IN INDUSTRIAL CORPORATIONS: CAN ADVANCED SOCIETIES LEARN TO CONTAIN POLLUTION,

Minnesota Univ., Minneapolis. Dept. of Sociolo-

gy. R. E. Rickson.

R. E. RICKSON.
Available from the National Technical Informa-tion Service as PB-223 504, \$3.00 in paper copy, \$1.45 in microfiche. Minnesota Water Resources Research Center, St. Paul, Bulletin 62, August 1973. 23 p, 34 ref. OWRR B-047-MINN (1). 14-31-

Descriptors: \*Decision making, Pollution, Control, \*Minnesota, Organization, Environmental effects, Industries, \*Research and development, Social change. Identifiers: \*Policy decisions

The development and distribution of knowledge has long been of interest to policy-makers and so-cial scientists. Because of the power of industrial corporations and the influence they have over the general research and development process, socie-ties have the knowledge to deal with problems that coincide with corporate goals but have difficulty handling problems where solutions are, in the handling problems where solutions are, in the short run, contradictory to the uninterrupted pur-suit of economic goals. A good example is societal ability to deal with waste or pollution. Two processes are important: (1) the process by which resources are allocated to research at the corporate and societal level and (2) the management of the expert role by organizations. (Walton-Minnesota) W73-14365

PHOSPHORUS REMOVAL BY TRICKLING FILTER SLIMES, Marquette Univ., Milwaukee, Wis. Dept. of Civil For primary bibliographic entry see Field 05D. W73-14372

ULTIMATE MANAGEMENT OF RADIOAC-TIVE LIQUID WASTES, Idaho Nuclear Corp., Idaho Falls. C. M. Slansky, and J. H. Buckham.

Chemical Engineering Progress Symposium Series No. 97, Vol 65, 1969, p 26-31, 6 fig, 2 tab, 17 ref.

Descriptors: "Radioactive waste disposal, "Nu-celar power plants, "Electric power production, Public health, Food chains, Liquid wastes, Separation techniques, Transportation, Storage, Ultimate disposal, Radioisotopes, Water quality control, "Waste disposal. Identifiers: "Transmutation, Half-life.

An estimated 7950 metric tons of fission products will result from nuclear electric power generation in the year 2000, if current trends continue. in the year 2000, if current trends continue. Development of nuclear processes is such that an economical method of ultimate disposal of such wastes has not been developed, although if such a method had been developed, it would undoubtedly be obsolete in 30 years anyway. Therefore, the problem to be faced now is interim storage of waste products so that the short-lived radioisotopes can decay and the long-lived radioisotopes can decay and the long-lived radioisotopes can be retrived for ultimate processing, should also be within the means of smaller developing nations which desperately need the nuclear power. Methods of ultimate disposal currently being investigated include transmutation to stable isotopes in a nuclear reactor, and transportation by rocket to the sun or other suitable locations. Ultimate storage in ocean trenches and deeps has been proposed and is being investigated. Current practices of interim storage include mainly underground storage of liquid or solid containerized wastes. Further extensive testsolid containerized wastes. Further extensive test-ing is needed for all phases of both disposal, ulti-mate storage and interim storage to protect the en-vironment from serious damage. (Lowry-Texas) W73-1439

LOW LEVEL BOD DETERMINATIONS BY THE ELECTROLYSIS METHOD,

Iowa State Univ., Ames.
For primary bibliographic entry see Field 05A.

CANADA ANIMAL WASTE MANAGEMENT Department of Agriculture, Ottawa (Ontario).
Animal Waste Management Guide Committee.

1972, 57 P. 9 TAB., 4 FIG., APPEND.

Descriptors: \*Farm wastes, \*Livestock, \*Production, \*Design, \*Management, Pollution, Manure utilization, Nitrogen, Farm lagoons, Aerated utilization, Nitrogen, Farm lagoons, Aerated lagoons, Aerobic treatment, Anaerobic digestion, \*Waste storage, \*Waste disposal, Dehydration, Incineration, Zoning, Regulations, Legal aspects, Equipment, Fertilizers, Canada. Identifiers: \*Canadian legislation, Dead bird disposal, Composting.

Current Canadian practices which provide reasonable approaches to handling animal wastes were compiled with particular emphasis on using the land as a recycling system. Detailed informa-tion is given for (1) manure management, (2) utilization of manure handling systems, and (4) processing of animal wastes. Relevant legislation on animal waste management in each province and addresses of equipment manufacturers are also included. (Dudley-East Central) W73-14392

ATURE OF CHEMISTRY IN THE NA-TIONAL SEA GRANT PROGRAM, National Oceanic and Atmospheric Administra-tion, Rockville, Md. For primary bibliographic entry see Field 02K. W73-14397 THE NATURE OF CHEMISTRY IN THE NA-

PRODUCTION, POLLUTION, PROTECTION, For primary bibliographic entry see Field 05B. W73-14430

EFFECTS OF ARTIFICIAL DESTRATIFICA-TION ON PRIMARY PRODUCTION AND ZOOBENTHOS OF EL CAPITAN RESERVOIR,

ZOOBENTHOS OF EL CAPITAN RESERVOIR, CALIFORNIA, Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife. For primary bibliographic entry see Field 05C. W73-14444

MODELS FOR MANAGING REGIONAL WATER QUALITY, Harvard Univ., Cambridge, Mass. Harvard Water

Harvard University Press, Cambridge, Mass., 1972. R. Dorfman, H. D. Jacoby, and H. A. Thomas, Jr., Editors. 453 p.

Descriptors: \*Mathematical models, \*Water quali-Descriptors: "Mathematical models, "water quan-ity control, "Municipal water, River basins, Estua-ries, "Mangement, "Decision making, "Optimiza-tion, Political aspects, "Regional analysis, Analyti-cal techniques, Stochastic processes, Multiple-

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

purpose reservoirs, Economics, Technology, Waste water treatment, Tertiary treatment, Systems analysis. Identifiers: Biochemical pollution, Human wastes, Artificial aeration, Public agencies, Delaware Estuary.

Nine essays are presented on various aspects of water quality control in a basin or estuary. They are unified by the conviction that the social and technological aspects of the problem are inseparable. The emphasis throughout is on the development of analytical models that can encompass that the assistant of the problem of the second problem. both the social and technological facets and ex-plore the practicability of integrating the physical, economic, and institutional aspects of regional water management. Primarily, models suited to biochemical pollution, rivers and extuaries, and municipalities are discussed. Included are: (1) The pollution problem in a historical setting; (2) a linear programming model of political decision making applicable to water resource problems and applied to a hypothetical basin; (3) a model of municipal avior under the uncertainty of supply; (4) unochavio under the uncertainty of supply, (v) un-certainty as it affects design and operating deci-sions made by public agencies; (5) dynamic pro-gramming to evaluate the use of artificial aeration to control dissolved oxygen in estuaries; (6) waste-water conveyance and regional treatment facilities; and (7) flow regulation for quality control, emphasizing political admissibility, and utilizing linear programming. (See W73-14458 thru W73-14466) (Bell-Cornell)

WASTE DISPOSAL IN NATURAL WATER-

Harvard Univ., Cambridge, Mass. Dept. of Sanita-

ry Engineering. H. A. Thomas, Jr.

In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H. D. Jacoby, and H. A. Thomas, Jr.), Harvard University Press, Cambridge, Massachusetts, p 1-41 (Chapter 1), 1972. 4 fig, 10 tab, 31 ref.

Descriptors: \*Water pollution control, \*Natural streams, \*Waste disposal, \*Mathematical models, Water quality, Analytical techniques, Sanitary en-gineering, Industrial wastes, History, Ecology, Management, \*Regional analysis, Massachusetts, Management, regional analysis, Massachusetts, Equations, Hydrologic data, Biomass, Lakes, Estuaries, Reaeration, Biochemical oxygen de-mand, Systems analysis, Economics. Identifiers: \*Biochemical pollution, Human wastes, Dilution, Natural purification, Pollution load, Synecology, Streeter-Phelps formulation.

This essay provides a broad perspective of the pollution problem in an historical setting. Methods of analysis of stream pollution problems are described with three objectives: (1) To discuss the ecological principles on which the methods are based; (2) to comment on the reliability of predic-tions relating pollution load to water quality, and to indicate gaps in present knowledge; and (3) to examine limitations of the water-carriage system of waste disposal with further economic growth. Developments are presented in historical sequence, with advanced theories interpolated to provide perspective relating to strengths and limitation of current sanitary engineering practice based largely on investigations of the U.S. Public Health Service during the early 20th Century. Subsequent improvements of the classical theory are then outlined, and recent research trends in areas where present methods are unsatisfactory are indicated. Special attention is given to biochemical pollution from human and industrial wastes and to the empirical basis of the mathematical models commonly used to describe this phenomenon. As commonly used to describe this pachoneholi. As an introduction to the mathematical analysis of water pollution, a water pollution crisis that arose in Massachusetts at the the turn of the century) examined. (See also W73-14457) (Bell-Cornell)

CONCEPTUAL MODEL OF A REGIONAL WATER QUALITY AUTHORITY, Harvard Univ., Cambridge, Mass.

In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H. D. Jacoby, and H. A. Thomas, Jr.), Harvard University Press, Camdge, Massachusetts, p 42-83 (Chapter 2), 1972. 4

Descriptors: \*River basin commissions, \*Water quality, \*Management, \*Mathematical models, \*Political aspects, Engineering, \*Pollution abatement, Social aspects, Economics, Technology, Decision making, Data collections, Data processing, Evaluation, Systems analysis, Costbenefit analysis, Benefits, \*Regional analysis. Identifiers: Constrained maximization, Prediction.

Water quality management decisions are reconciliations of diverging opinions and conflicting in-terests. This fact is almost universally ignored, however, in most discussions of water resource however, in most discussions of water resource design and project evaluation. Consequently, there are no known methods of design which account for political considerations. The first of a pair of essays that endeavors to integrate social and economic considerations with the technical and engineering aspects of water quality management, this article proposes a model of political decision making applicable to water resource problems, and advocates its application to the analysis of pollution control institutions and projects. The model collects and organizes pertinent data, and predicts that certain initially conceivable decisions will not, in fact, be adopted. Described data, and predicts that certain initially conceivable decisions will not, in fact, be adopted. Described at some length is the milieu in which river basin authorities operate and the considerations that impinge upon their decisions. Discussed is how these considerations could be formalized and quantified; it is seen that the authority's decision problem can be expressed as a family of formal mathematical problems involving constrained maximization. It is deduced that benefit-cost analysis presupposes the agency 'knows best' what the objectives of society are with respect to matters within its jurisdiction, and can arrive at decisions without consulting the citizens concerned. (See also W73-14457 and W73-14460) (Bell-Cornell) W73-14459

AN ILLUSTRATIVE MODEL OF RIVER BASIN POLLUTION CONTROL, Harvard Univ., Cambridge, Mass. R. Dorfman, and H. D. Jacoby. In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H. D. Jacoby, and H. A. Thomas, Jr.), Harvard University Press, Cambridge, Mass., p 84-141 (Chapter 3), 1972. 6 fig, 11 tab. 5 ref. 1 append. tab, 5 ref, 1 append.

Descriptors: \*River basin commissions, \*Water pollution control, \*Management, \*Political aspects, \*Mathematical models, Standards, "Water quality standards, Decision making, Costs, Municipal wastes, Industrial wastes, "Regional analysis, Technology, Planning, Systems analysis.

That water quality management decisions are reconciliations of diverging opinions and conflicting interests is almost universally ignored in most discussions of water resource design and project discussions of water resource design and project evaluation. Consequently, there are no known methods of design which account for political considerations. The second of a pair of essays that endeavors to integrate social and economic considerations with the technical and engineering aspects of water quality management, this article tests a conceptual model of political decision making applicable to water resource problems by applying it to a hypothetical river basin. Several municipal and industrial dischargers contribute to the generally poor quality of the sample river; most of these same agents, along with others, both inside and outside the basin, have an interest in bringing the river to a higher quality standard. The questions are how high a standard to strive for and who should bear the cost of achieving it. The model collects and organizes pertinent data, and predicts that certain initially conceivable decisions will not, in fact, be adopted. The model focuses on a pollution control commission charged with forand on the way economic and technical factors combine with political considerations to influence commission decisions. (See also W73-14457 and W73-14459) (Bell-Cornell)

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MUNICIPAL EVALUATION OF REGIONAL WATER QUALITY MANAGEMENT PROPOSALS,

Resources for the Future, Inc., Washington, D.C.

C. S. Russell.
In: Models for Managing Regional Water Quality
(ed. by R. Dorfman, H.D. Jacoby, and H.A.
Thomas, Jr.), Harvard University Press, Cambridge, Mass., p 142-203 (Chapter 4), 1972. 9 fig, 12
tab, 46 ref, 1 append.

Descriptors: \*Water quality control, \*Benefits, Estimating, \*Evaluation, \*Mathematical models, \*River basin commissions, \*Decision making, Alternative planning, Political aspects, Human population, Water supply, Water treatment, Costs, Aesthetics, Recreation facilities, Cost-benefit theory, Financing, Cost sharing, Municipal water, Chemicals, Biochemical oxygen demand, Equations, Systems analysis, \*Regional analysis, \*Ingrovements Interest groups, and the property of the pr Identifiers: Improvements, Interest groups, Nashua (N.H.), Dissolved minerals, Group

benefits.

Presented is an approach to the problem of mu-nicipal evaluation of the benefits from local water quality improvements. The attitudes of municipal authorities are important influences on comi sion decision making. As a result, the analysis of basin-wide quality decisions requires an estimate of the value of alternative plans, as viewed from the standpoints of participating cities. Municipal authorities' acceptance or rejection of a regional authorities acceptance of rejection of a regional scheme depends on their balancing of tis consequences for their various constituents, who enjoy city benefits but also must pay taxes. A model of municipal behavior in these circumstances is formulated and tested. The model and plementation are discussed in two parts: (1) The identification of interest groups and the esti-mation of group benefits from various levels of quality improvement and of the group cost shares under alternative financing plans; and (II) the combination of these estimates within the framework of a political constraint and a set of relative group political weights (municipal willingness to pay for aesthetic improvement and increased recreat opportunities). An application of the model to Nashua, New Hampshire is presented. An appen-Nashua, New Ampshire 5 presenter. An appearation of the Customers—Their Conceptual Role and Some Empirical Results' is included. (See also W73-14457) (Bell-Cornell)

OPTIMUM GOVERNMENT INVESTMENT IN SUPPLY SYSTEMS YIELDING UNCERTAIN S. J. Turnovsky

In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H.D. Jacoby, and H.A. Thomas, Jr.), Harvard University Press, Cam-bridge, Mass., p 233-264 (Chapter 6), 1972. 2 fig, 14

Descriptors: \*Governments, \*Investment, \*Management, Economics, \*Design, \*Optimization, \*Stochastic processes, Estimating, Benefits, Marginal costs, Marginal benefits, Decision making, Equations, Mathematical models, Systems analysis, \*Risks. Identifiers: \*Supply systems, Nonlinear programming, Consumers.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

In water resources project development, one must account for inevitable uncertainties in system performance due to variation in the myriad system inputs and parameters. This is the second of a pair of puts and parameters. Ins is the second of a pair of articles which considers the special problem of uncertainty as it affects the design and operating decisions made by public agencies. This article considers the optimal planning of public investment and management schemes when there is a stochastic component in the patient of control of the component in the patient of control of the component in the patient of control of the control of stochastic component in the pattern of goods they provide. Particular attention is paid to the estima-tion of benefit functions in this situation, and to the design of supply systems when output variance is subject to control. With the aid of a model based on consumer decision making where supplies are stochastically determined, a procedure for estimating the expected benefits from consuming such commodities is derived. The results are then used to determine the optimal price and design for a stochastic supply system; the optimization is per-formed in two steps: (1) determination of how to select specifications that will enable a supply system of a given quality to be achieved most economically; and (2) assuming an efficient design, the socially optimal price and the standard deviation, mean, and reliability of the supply are established. (See also W73-14457 and W73-14462) (Bell-Cornell)

#### ARTIFICIAL AERATION AS A SUBSTITUTE FOR WASTEWATER TREATMENT, L. Ortolano.

L. UTOIANO.

In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H.D. Jacoby, and H.A. Thomas, Jr.), Harvard University Press, Cambridge, Mass., p 265-311 (Chapter 7), 1972. 4 fig, 4 tab, 34 ref.

Descriptors: "Water pollution control, "Tertiary treatment, "Aeration, "Dissolved oxygen, "Optimization, Model studies, Costs, "Numerical analysis, Management, Water quality, Standards, Dynamic programming, Alternative planning, Esturaries, Streams, Economies of scale, Equations, Systems analysis, Waste water treatment. Identifiers: "Delaware Esturary, Computer algorithms, Cost functions, Sensitivity analysis.

Artificial aeration is the deliberate introduction of oxygen into a watercourse to enhance self-purifi-cation. Mathematical models are used to examine the role of artificial aeration as a substitute for tertiary treatment in the control of the dissolved oxygen levels of streams and estuaries. The models determine the location and sequencing of artificial acrators and tertiary treatment plants to meet the specified water quality standards at minimum cost. The models presented increase in complexity from a simple case involving only a single aerator loca-tion and no tertiary treatment, to a very general case involving an arbitrary number of aeration lo-cations and waste sources. The simpler models are appropriate for individual municipalities or industries, while the more general models can be used for regional planning. Most of the cases discussed are illustrated by numerical examples based on data from the Delaware Estuary, somewhat sim-plified for ease of computation. The models consistently yieldsolutions favoring artificial aeration over tertiary treatment. Various sensitivity analyses indicate that aearation figures prominently in model solution even when aeration cost parameters are increased significantly. (See also W73-14457) (Bell-Cornell) W73-14464

#### WASTEWATER CONVEYANCE MODELS,

In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H.D. Jacoby, and H.A. Thomas, Jr., Harvard University Press, Cam-bridge, Mass., p 312-361 (Chapter 8), 1972. 4 fig, 11

Descriptors: \*Water quality control. \*Waste water Descriptors: "Water quanty control, "water water treatment, "Conveyance structures, "Pipes, "Treatment facilities, "Regions, Design, Management, Optimization, Economics, Technology, Costs, Size, Flow rates, Hydraulic gradient, Economics of scale, Scheduling, Investment, Methodology, Estuaries, Equations, Systems analysis Identifiers: Delaware Estuary, Cost functions.

Technological and cost functions pertaining to waste water treatment and conveyance are developed in a form appropriate for incorporation in a comprehensive model for regional management of water quality. The transporting of wastes to some combination of regional treatment plants, or piping them out to sea, is considered as an alternative to on-site waste removal. The model identifies efficient spatial and temporal patterns of wastewater treatment, conveyance, and ultimate disposal to receiving water at a stage in the over-all project design in which the principal waste sources have been determined, and decisions have been made regarding water quality in the streams. It accommodates several waste sources, treatment plants, and alternative discharge points; solutions give schedules of construction of control works and operation of the various components over a period of 20-30 years. The objective function includes cost of construction and operation of the various components discounted to the present. Used is a sample problem concerned with mulosed is a sample problem contented with mul-tiperiod planning of estuarine quality control and utilizing data from the Delaware Estuary. A modified form of Roger's technique of random sampling has been used in an application of the model to the polluted estuary. (See also W73-14457) (Bell-Cornell)

# FLOW RECULATION FOR WATER QUALITY MANAGEMENT, Cornell Univ., Ithaca, N.Y. Dept. of Environmen

Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering.
D. P. Loucks, and H. D. Jacoby.
In: Models for Managing Regional Water Quality (ed. by R. Dorfman, H.D. Jacoby, and H.A. Thomas, Jr.), Harvard University Press, Cambridge, Mass., p 362-431 (Chapter 9), 1972. 11 fig, 8 tab, 11 ref. OWR Projects C-1034 (No. 1575) (2) and C-1640 (No. 3151) (6).

Descriptors: \*Political aspects, \*Flow control, \*Water quality control, \*Linear programming, \*Multiple-purpose reservoirs, \*Management, Reservoir storage, Analytical techniques, Model studies, Evaluation, Streams, Waste treatment, River basins, Stochastic processes, Digital compu-ters, Simulation analysis.

Flow regulation is considered as a means of quali-ty control. A set of deterministic and stochastic linear programming models is developed to screen alternative multipurpose flow regulation schemes-and the associated waste treatment plans-in-search of those few that warrant detailed analysis by digital simulation. A mathematical model of carbonaceous and nitrogenous biochemical pollu-tion and a model of political decision making are combined to screen flow regulation and wastecommed to screen flow regulation and waste-water treatment alternatives according to the likelihood of their political admissibility, as well as their economic and technical feasibility. The models are applied to a hypothetical Bow River Valley planning problem developed in previous chapters of the book. (See also W73-14457) (Bell-W73-14454) W73-14466

# CONCEPTS FOR EFFECTIVE MANAGEMENT OF WATER QUALITY IN CONNECTICUT, Connecticut Dept. of Environmental Protection, Hartford.

R. B. Anderson.

University of Connecticut, Storrs, Institute of Water Resources Report No. 18, April 1973, 54 p, 16 fig, 41 ref.

Descriptors: \*Water quality, \*Water management (Policy), \*Water pollution control, Economics, \*Connecticut, Evaluation, Institutional con-straints, Management.

The basic elements necessary for an effective water quality management program are presented with concept limitations. Economic factors are illustrated by comparing water quality management to a free market condition. Engineering considera-tions are discussed including mathematical water quality predictive models and other technical conons. The behavior of local governments is analyzed as it relates to regional water quality management aspects. A conceptual approach with a real world example is presented for analyzing water quality management and waste treatment management problems. The example consists of a waste discharger and a downstream water user with minimum water quality requirements. At-tempts to define least cost and cost effective pollution abatement strategies as well as to perform cost analyses of specified water quality standards are described. W73-14471

# MIDDLETOWN STREAMBELT REPORT. Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 04D. W73-14484

### SKETCH REGIONAL WATER AND SEWER PLAN. Neuse River Regional Planning and Development

Council, New Bern, N.C. For primary bibliographic entry see Field 03D. W73-14488

# STUDY DESIGN FOR A REGIONAL SEWER

AND WATER PLAN.
Cuyahoga County Regional Planning Commission,
Cleveland, Ohio.
For primary bibliographic entry see Field 03D.
W73-14489

# LANCASTER COUNTY PLANNING COMMISSION: STORM DRAINAGE STUDY. Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 08B.

WATER, SEWER, AND STORM DRAIN STUDY, UTAH COUNTY, UTAH, VOLUME I: BACKGROUND AND INVENTORY.
Despain (I. Dale) and Associates, Provo, Utah. nary bibliographic entry see Field 05D.

# WATER, SEWER AND STORM DRAIN STUDY, UTAH COUNTY, UTAH: VOLUME II, PLAN

Despain (I. Dale) and Associates, Provo, Utah. For primary bibliographic entry see Field 05D. W73-14493

# REPORT ON HALF MOON LAKE. Half Moon Lake Restoration Committee, Eau

March 1973. 106 p, 5 fig, 12 tab, photos, 8 ref, ap-

Descriptors: Water quality, \*Water quality control, \*Recreation, \*Environmental effects, Water pollution, Nutrients, Financing, Shoreline cover, Fishing lakes, Effluents, \*Wisconsin.

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

Identifiers: \*Shoreline maintenance, Eau Claire (Wisc), Shoreline development, \*Half Moon Lake (Wisc).

The Half Moon Lake Restoration Committee was created by the City of Eau Claire in 1971 to study the deteriorating quality of the lake and to deter-mine ways to improve it. Lying entirely within the city limits, the lake, relatively shallow with a maximum depth of 9 feet, is a 132 acre ox bow cutoff of the Chippewa River. Renewal water comes from small springs, storm sewers, rain and snow-fall. The Committee focused on questions of the history and quality of urban development on the five mile shoreline of the lake, sources of water and flow of water, water quality in the lake, recreational opportunities offered by the lake and nall springs, storm sewers, rain and snow adjacent park complex, and means of financing proposed improvements. The Committee views the Carson Park-Half Moon Lake complex as an extremely important recreation asset in the county and thus recommends a three-phase plan for improvement. Phase I consists of actions that can be undertaken immediately and will offer significant benefits. These actions include a shoreline maintenance program, a citizen clean-up campaign, land acquisition, wherein as much private ownership as possible should come under public ownership or public control. Scenic easements should be where purchase by the city is impossible. Phase II includes projects that require considera-ble study and investment including facilities to improve the water quality of the lake by using a well capable of delivery 2.5 mgd as a supplemental source to reduce nutrient content by flushing effect; provision of an iron removal process; removal of silt and oils from storm sewers by crea-tion of sedimentation facilities. Phase III would include long term projects such as the construction of a dam to control silt entering the lake and the diversion of storm water runoff. (Elfers-North Carolina) W73-14494

DES PLAINES RIVER VALLEY: GOALS, POLI-CIES, AND RECOMMENDATIONS. Des Plaines River Valley Comprehensive Plan Steering Committee, Ill. For primary bibliographic entry see Field 06F. W73-14495

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM. Tulare County Planning Dept., Visalia, Calif.

Prepared for Tulare County Association of Governments, December 1971. 354 p, 26 fig, 6 tab, 46 plates, 6 append.

Descriptors: \*Planning, \*Water supply, \*Sewerage, Environmental effects, Urbanization, Land use, Water demand, Projections, Financing, Coordination, Rural areas, \*California. Identifiers: \*Urban growth policies, \*Utility extension policies, \*Tulare County (Calif), Kaweah River basin (Calif), Three Rivers (Calif).

The purpose is not only to plan for future county-wide water supply and wastewater disposal systems, but also to help formulate a county-wide growth strategy and face several crucial issues related to land use planning and environmental quality. This report is closely related to other elements of the County's General Plan and to the pilot study to develop a prototype Environmental Resources Management Element of a General Plan. Scope is limited to rural areas of the county, unincorporated communities and cities with a population of less than 5,500. These communities were classified as: Farm Labor Residential Community, Minor Rural Service Center; Major Rural Service Center; Municipality; Unincorporated Residential Tract; and Recreation Oriented and Retirement Community. Sections on the specific planning sub-areas and projections, evaluation of existing water

supply and wastewater systems, future water demands and wastewater loads, water quality objectives, recommended management plans, and plan implementation, especially financing are presented. Some of the recommendations include the provision of water and sewer services only to communities with a favorable growth prognosis, the development of additional groundwater recharge facilities, the discouragement of scattered and fragmented systems, the extension of existing aystems to promote orderly urban growth, the prohibiting of system extensions in airport zones, flood plains, aquifer recharge areas, and potential recreation areas, and the discouragement of the use of septic tanks. (See also W73-14498) (Elfers-North Carolina)

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM-PART II.

Tulare County Planning Dept., Visalia, Calif.

Prepared for Tulare County Association of Governments, June 1972. 163 p, 31 fig, 26 tab, 2 append.

Descriptors: "Planning, "Water supply, "Sewerage, Environmental effects, Urbanization, Land use, Water demand, Projections, Financing, Groundwater recharge, "California. Identifiers: "Urban growth policies, "Utility extension policies, "Tulare County (Calif), Central Valley Project (Calif), Dinuba (Calif), Tulare (Calif), Visalia (Calif).

This report is the second part of a very comprehensive effort to plan for future water supply and wastewater disposal systems for Tulare County, particularly in relation to issues of environmenquality and land use planning. It contains an overview of the growth pattern of three cities, Dinuba, Tulare and Visalia, whose urbanized acreage for each community is expected to double by 1990, and their key water supply and pollution problems. These cities are situated on the valley floor overlying an extensive underground reser voir which provides a potable water supply for domestic and municipal services. Planning factors such as socio-economic development, population, and land use are examined. An evaluation of existing water supply and wastewater systems, recommendations for expansion of these systems, and a discussion of financing and implementing these improvements are included. Some of the recommendations include the full support of the Central Valley Project which would convey water from the Sacramento area, the development of additional groundwater recharge facilities, the extension of central water and sewerage systems to promote orderly growth, the discouragement of septic tanks via zoning and subdivision regula-tions, the exclusion of sewer trunk lines from areas planned for agricultural and open space uses, and the adoption of ordinances requiring pretreatment of certain wastes at their source. (See also W73-14497) (Elfers-North Carolina)

WATER RESOURCES OF MIDDLE GEORGIA. Briley, Wild and Associates, Daytona Beach, Fla. For primary bibliographic entry see Field 06D. W73-14499

MASTER PLAN FOR STORM DRAINAGE: FORT WAYNE-NEW HAVEN-ALLEN COUNTY METROPOLITAN AREA. Schnelker (Philip L.), Inc., Fort Wayne, Ind. For primary bibliographic entry see Field 06B. W73-14500 AMARILLO, TEXAS: REPORT ON SANITARY SEWERAGE AND SEWAGE TREATMENT,

Freese, Nichols and Endress, Fort Worth, Tex. For primary bibliographic entry see Field 05D. W73-14501

POLLUTION IN A NEO-CLASSICAL WORLD. -THE CLASSICS REHABILITATED, S. K. Kuipers, and A. Nentjes. The Economist, Vol 121, No 1, p 52-67, 1973. 3 fig,

Descriptors: \*Theoretical analysis, \*Pollution abatement, \*Gross National Product, \*Limiting factors, Economic efficiency, Mathematical models, Agriculture, Industries, Environment, Productivity, Employment.
Identifiers: \*Pollution control costs, \*Economic economic economi

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Increasing returns to industry and output growth resulting from technical progress, capital accumulation and working population growth is the basis of the neo-classical growth theory. The effect of the rising cost of economic growth now incurred by the recognized necessity of pollution abatement in this theory is investigated and a rehabilitation of the classical theory of growth is recommended. This would involve recognition of the environment as a scarce resource and, thus, the increasing costs of pollution could, under certain assumptions, place a limit on the growth output. A simplified model which associates pollution costs with capital stock and quantity of environment in a specific country and includes the possible effects of several forms of technical progress is employed. The analysis indicates that the neo-classical golden age' of continuous full employment is only a special case in which land-augmenting technology exceeds the growth rate of labor in efficiently units and the propensity to save is sufficently high. Under alternative parametric values the model generates a classical progressive state or a classical semi-stationary state. This analysis is compared to the Club of Rome's publication 'The Limits to Growth.' (Weaver-Wisconsin)

THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES: LEAD. PART I. INTRODUCTION AND EXECUTIVE SUMMARY.

Charles River Associates, Inc., Cambridge, Mass.

Available from the National Technical Information Service as PB-207 155, \$3.75 in paper copy, \$1.45 in microfiche. Report prepared for Council on Environmental Quality, December 1971. 21 p, 3 tab.

Descriptors: \*Pollution abatement, \*Economic impact, Air pollution, \*Water pollution control, Costs, Zinc, Lead, Industries, Regulation. Identifiers: \*Lead industry, Sulfur dioxide, Market analysis, Industry organization.

A broad profile of the lead industry is presented including its market environment, technology, and internal structure. The probable economic effect and costs to meet the Environmental Protection Agency standards of sulfur dioxide emissions from smelters into the air and waste discharges into water are evaluated, giving estimates of long-run costs for attaining 90% feed sulfur removal. Although long-run consumption trends (growth at 1% per year) are not expected to be altered due to the relative price inelasticity of demand for lead and the small price increases required to finance pollution control costs, a loss of 40% of the tetraethyl market is expected by 1975 due to increased use of lead-free gasoline. Replacement of older mines and smelters and increased market concentration are expected supply trends, which will be accelerated as pollution control costs real-

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

locate supply from high- to low-cost producers due to the disproportionate incidence of these costs to high-cost producers. (See also W73-14517) (Weaver-Wisconsin) W73-14516

THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES: LEAD. PART II. STRUCTURE OF THE INDUS-Charles River Associates, Inc., Cambridge, Mass.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-207 156, \$4.85 in paper copy, \$1.45 in microfiche. Report prepared for Council on Environmental Quality, December 1971, 92 p, 2 fig. 4 tab.

Descriptors: \*Industries, \*Lead, Industrial production, Marketing, Prices, Mining, Regulation, Economic impact, Pollution abatement, \*Missouri, Water pollution control. Identifiers: \*Industry structure.

General and specific characteristics of the lead industry and its market environment (including ded and supply conditions, the state of technolo gy, the structure of the industry, price trends and industry-relevant governmental policies) are reviewed in order to provide a basis for the economic evaluation of pollution controls on the lead industry. Supply trends indicate that the U.S. is gaining an increasing share of world production due to low-cost technologies applicable to new deposits discovered in Missouri. Although mining costs vary considerably among firms, a typical any faces large fixed costs, sharply increasing short-run costs, and nearly constant average costs for moderate short-run output changes or substantial long-run changes. Smelting and refining, which account for the greatest proportion of costs in lead production are the greatest sources of pollution due to sulfur dioxide emissions and their relatively costly conversion to sulfuric acid. Lead consumption has increased at an annual rate of 1% due mainly to the battery industry, although a short-run decline in the tetraethyl market is expected. Because no close substitutes exist for lead, its demand is highly price inelastic, although inventory fluctuations associated with the business cycles and changes in capacity have caused periodic price instability. Increasing industry concentration is expected due to the introduction of large, high quality ore reserves in Missouri. A review of the industry indicates a natural division between high- and low-cost producers. (See also W73-14516) (Weaver-Wisconsin)

U.S. DEEPWATER PORT STUDY. VOL. 1. SUM-MARY AND CONCLUSIONS, Nathan (Robert R.) Associates, Inc., Washington.

For primary bibliographic entry see Field 06B. W73-14524

TRANSACTIONS OF THE 37TH NORTH AMERICAN WILDLIFE NATURESOURCES CONFERENCE,
For primary bibliographic entry see Field 06G.
W73-14526 NATURAL

CHANGES IN BEACH PROFILES AT CHEDABUCTO BAY, NOVA SCOTIA, FOL-LOWING LARGE-SCALE REMOVAL OF SEDI-Bedford Inst., Dartmouth (Nova Scotia), Atlantic

Geoscience Center. For primary bibliographic entry see Field 02J. **ENVIRONMENTAL EFFECTS OF HYDRAULIC** 

DREDGING IN ESTUARIES, Alabama Marine Resources Lab., Dauphin Island. For primary bibliographic entry see Field 05C. W73-14621

WATER RESOURCES IN SANTA CLARA COUNTY: A PLAN FOR CONSERVATION, For primary bibliographic entry see Field 03D. W73-14675

RIVERFRONT DEVELOPMENT PLAN, CON-NECTICUT RIVER, SPRINGFIELD, MAS-SACHUSETTS. Springfield Planning Dept., Mass.

For primary bibliographic entry see Field 03D. W73-14676

WATER SUPPLY PLAN (REVISED) FOR COLUMBUS-FRANKLIN COUNTY, Mid-Ohio Regional Planning Commission, Colum-

For primary bibliographic entry see Field 06D.

HOWARD COUNTY, INDIANA: COMPREHEN-SIVE WATER AND SEWER PLAN. Hamilton (Ernest R.) Associates, Inc., Indianapolis, Ind. For primary bibliographic entry see Field 03D. W73-14680

WATER AND WASTEWATER PLAN FOR AN-DERSON, BLOUNT, AND KNOX COUNTIES, TENNESSEE - VOLUME I, WATER SUPPLY AND DISTRIBUTION. Allen and Hoshall, Memphis, Tenn.

Report ET-SA-18-1-72 prepared for East Tennes-see Development District, Knoxville, July 1972. 188 p, 18 fig, 59 tab, 2 append. CPA-TN-04-00-0136.

Descriptors: \*Water supply, \*Water distribution, Planning, Coordination, \*Tennessee. Identifiers: \*Utility extension, \*Knoxville SMSA,

\*Utility extension policies, Knoxville (Tenn), Anderson County (Tenn), Blount County (Tenn), Knox County (Tenn).

Water for the three-county Knoxville SMSA (Standard Metropolitan Statistical Area) is currently provided by twenty-eight separate utility systems, several of which provide inadequate service due to inadequate supply, inadequate treat-ment facilities, or inadequate distribution facilities. Only a few of these independent systems have formulated current or long-range plans re-garding water supply and distribution. This study reports individually on the operations of each system. By means of population forecasts and land use maps, the study team predicted future water requirements in the area. Recorded flows show an undance of surface water supply for the area's future needs. Land use and population projections would not justify a single regional water systems by 1990, but merger of several specific systems and establishment of three County Utility Boards to assure provision of recommended facilities in a coordinated and efficient manner are recom mended. Cost estimates for each recommended project are given, and construction of specific facilities in each county at 5 year increments through 1990 is recommended. (See also W73-14683) (Stein-North Carolina) 73-14682

WATER AND WASTEWATER PLAN FOR ANDERSON, BLOUNT, AND KNOX COUNTIES,

TENNESSEE - VOLUME II, WASTEWATER COLLECTION AND TREATMENT.
Allen and Hoshall, Memphis, Tenn.

Report ET-SA-18-II-72 prepared for East Tennes-see Development District, Knoxville, July 1972. 121 p, 8 plates, 30 tab, 4 append. CPA-TN-04-00-0136.

Descriptors: \*Waste water treatment, \*Sewerage, Septic tanks, Planning, \*Tennessee. Identifiers: \*Waste water collection, \*Knoxville (Tenn), Anderson County (Tenn), Knox County

Twelve wastewater utility systems now serve the three-county Knoxville SMSA (Standard Metropolitan Statistical Area), although public wastewater service is available only within municipal limits and in more densely inhabited areas of certain utility districts. Septic tanks are widely used, but present a hazard to the public welfare. Aside from insufficient territorial coverage, inadequacies of existing wastewater systems are at-tributable to excessive infiltration of surface water into collection systems or overloaded facilities brought on by new development. Few of the wastewater utility systems have current or longrange plans. High water-quality and effluent treatment standards promulgated by three state agencies constrain options for sewage treatment. Based on population and land-use forecasts, the study recommends specific wastewater service facility improvements through 1990. Population and land-use projections do not justify unified county systems, although County Utilities Boards are recommended to assure wastewater services on a coordinated, efficient basis. The study estimates costs of recommended projects and classifies all recommendations as short-range or intermediaterange priorities. Additional recommendations are county Sewer Use Ordinances and regulation of septic tanks. (See also W73-14682) (Stein-North W73-14683

ZERO DISCHARGE - THE ULTIMATE IN WATER CONSERVATION.

Battelle Inst., Geneva (Switzerland). Chemical and Environmental Engineering Systems Div. For primary bibliographic entry see Field 05D. W73-14684

BETTER WATER FOR PEOPLE IN LAS VEGAS.

Las Vegas Valley Water District, Nev.

T. R. Rice.
Journal of the American Water Works Association, Vol 65, No 4, p 229-231, April 1973. 3 photo.

Descriptors: "Water supply, "Water supply development, Pumping, Reservoir leakage, "Pollu-tion abatement, "Nevada. Identifiers: "Lake Mead (Nev), Southern Nevada Water Project, Las Vegas Valley Water District.

Although water for Las Vegas, whose population now exceeds 300,000 in the metropolitan area, originally came from several artesian wells, a lowered water table has long since caused the wells to cease their free flow. Today Las Vegas derives its water 57% from Lake Mead and 43% from well water. Since 1954, the Las Vegas Valley Water District has been operational as the prime supplier of water in Southern Nevada. Two years and over a million dollars have been spent for en-gineering and scientific studies of a water pollution problem caused by return flows entering Lake Mead via the Las Vegas Wash. A pollution-abate-ment program that will end pollution in Lake Mead and provide the means for reclaiming water for future use has been recommended to the state legislature. Unusual modern technology adopted by the Water District includes one of the largest gas-driven water-pumping stations in the world

#### Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5G-Water Quality Control

and one of the largest rubber-lined covered reserand one of the largest rubber-lined covered reservoirs. Current 5-year expansion plans call for facilities costing \$20 million to meet growing high per capita usage. (Stein-North Carolina) W73-14688

**ENVIRONMENTAL PROTECTION: NEW NAVY** 

DUTY, For primary bibliographic entry see Field 05D. For primar W73-14689

DISPOSAL OF OIL SPILL AT SEA,

O. B. Lindstron U. S. Patent No. 3,749,667, 2 p, 4 ref; Official Gazette of the United States Patent Office, Vol 921, No 5, p 1910, July 31, 1973.

Descriptors: \*Patents, \*Oil pollution, \*Oil spills, Separation techniques, \*Pollution abatement, Treatment, Water pollution control, Water quality control, \*Waste disposal. Identifiers: Oil disposal.

A method is provided of clearing up an oil spill by causing combustion of the burned oil to produce a cokey and tarry floating residue which can subsequently be sunk by adding a sinking agent to it. The sinking agent particles (less than 50 mm in size) should be spread over the burning oil. The particles become coated with the floating oil residue and dense enough to sink through the water. The sinking agent particles may be sand, gravel, chalk, gypsum, or slag of heavy minerals. (Sinha-OEIS) W73-14690

METHOD AND APPARATUS FOR REMOVAL OF SURFACE LIQUIDS,

Megator Pumps and Compressors Ltd., London (England). (assignee). F. W. McCombie.

U. S. Patent No. 3,748,264, 4 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 912, No 4, p 1530, July 24, 1973.

Descriptors: "Patents, "Oil spills, "Oil pollution, Equipment, Separation techniques, "Pollution abatement, Water quality control, Water pollution control, "Skimming.

The apparatus comprises a barrier which is extendable and forms an enclosure which may be contracted or extended as needed. It comprises a flotable support, a pair of drive drums mounted on the support, an elongated resilient barrier strip wound about each drum, a rear wall that forms a barrier, and a flotation element connecting the barrier, and a flotation element connecting the ends of the strips and the rear wall. The apparatus is completed by a skimming apparatus that forms the subject of U. S. Patent application Ser. No. 114,157. It can pump away the surface layer without removing an appreciable amount of the underlying liquid. A centrally placed suction pipe passing through a perforated strainer plate is surrounded by a circular weir. The lower end of the pipe is positioned in a dish shaped chamber below the plate. A principal objective of both inventions working together is to remove the surface layer of oil which may be in the form of a thin film. (Sinhaoil which may be in the form of a thin film. (Sinha-W73-14692

COALESCING FILTERS FOR OIL-WATER

Brunswick Corp., Skokie, Ill. (assignee) G. B. Peters.

U. S. Patent No. 3,743,599, 2 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 912, No 1, p 273, July 3, 1973.

Descriptors: \*Patents, \*Oily water, \*Separation techniques, Filtration, \*Filters, Emulsions, \*Pollution abatement, Water quality control, Water pollution control, Coalescence.

A coalescing filter for an oil-water separator comprises a pair of spaced flanges on a perforated tube which serves as the bobbin for coalescing windings. A winding of multiflament nylon twisted yarn completely encloses the perforated twisted yain completely encloses the periodical tube. The nylon winding is impregnated with an oleophilic resin which provides some mechanical stability to the winding and, more importantly, serves as a base for establishing an oil-resin membrane. (Sinha-OEIS) W73-14699

VORTEX FLOW SYSTEM FOR SEPARATING OIL FROM AN OIL-WATER MIXTURE, United Aircraft Corp., East Hartford, Conn. (as-

A. E. Mensing, J. W. Clark, and R. C. Stoeffler. U. S. Patent No. 3,743,095, 7 p, 9 fig, 3 ref; Offi-cial Gazette of the United States Patent Office, Vol 912, No 1, p 152, July 3, 1973.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Separation techniques, \*Pollution abatement, Water pollution control, Water quality control. Identifiers: Vortex flow system

An oil-water mixture, which has been removed from the surface of an oil spill, is pumped into a vortex tube at one end at a very high flow rate so as to impart a strong swirl to the flow in the tube. A small circular coreplate is positioned within an aperture at the center of the opposite end of the vortex tube from which the mixture enters. As the mixture swirls axially toward the opposite end wall, the difference in centrifugal forces due to density differences between the oil and water tends to accelerate the less dense oil radially inward to form a core region almost entirely of oil. The oil leaves the vortex separator through a port in the center of the wall at the end of the vortex in the center of the wall at the end of the vortex separator at which the mixture was injected. The flow surrounding the core, almost entirely water, leaves through the annulus in the downstream end wall and is returned to the body of water from which it was originally removed. (Sinha-OEIS) W72.14700.

SOIL EROSION-THE UNMENTIONED POL-LUTER.

Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 02J. W73-14720

A STUDY OF FORMATION PLUGGING WITH

For primary bibliographic entry see Field 08E. W73-14732

**ENVIRONMENTAL IMPACT REQUIREMENTS** IN THE STATES, Center for California Public Affairs, Claremont.

Available from the National Technical Informa-Avaitable from the National Technical Informa-tion Service as PB-223 748, \$3.00 in paper copy, \$1.45 in microfiche. Environmental Protection Agency, Socioeconomic Studies Series, Report EPA-R5-73-024, June 1973. 20 p. EPA Contract 68

Descriptors: \*Water quality standards, \*State governments, \*Environmental effects, Legislation, Legal aspects, Water quality control, Water

Quality Act.
Identifiers: \*Environmental Impact Statements,
Feelogical impact, Water quality requirements, Ecological impact, \*Environmental Protection Act.

The requirements of Environmental Impact Analyses for each of the various states has been surveyed. In eight states and in Puerto Rico, impact statements are a statutory requirement; in four states, they are required by Executive Order. In a few cases, the impact statement requirement extends to local as well as state agencies. (EPA)

W73-14749

#### 06. WATER RESOURCES PLANNING

#### 6A. Techniques of Planning

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: 1973 CONTRIBUTIONS, California Univ., Los Angeles. Dept. of EngineerPr

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C. M. Duke, and S. E. Jacobsen.
Available from the National Technical Informa-tion Service as PB-223 359, \$4.25 in paper copy, tion Service as PB-223 339, 34.23 in paper copys \$1.45 in microfiche. California Water Resources Center, Davis, Contribution No. 141, June 1973. 113 p, 20 fig, 13 tab, 48 ref. OWRR B-146-CAL (2), B-107-CAL (2), B-122-CAL (1), and B-144-CAL

Descriptors: Earthquakes, \*Earthquake engineering, Planning, \*Project planning, \*Damages, Probability, \*California, \*Optimization, Model studies, Costs, \*Water distribution (Applied), \*Attenuation, Optimal development plans.
Identifiers: San Fernando, Los Angeles, San Frances

A three-part report covers several phases of the project: (1) A renewal theoretic model is developed for the purpose of evaluating expected future damage costs due to earthquakes for a segment of a water distribution system located in a large seismic region. A probabilistic model is used to obtain expected future damage costs as a function of design intensity and a numerical example is included to indicate the usefulness of the included to indicate the usefulness of the methodology. (by S. E. Jacobsen, M. Torabi and P. B. Bansal). (2) Occurrence of earthquakes in terms of space, size, and time distributions is combined with site functions to establish probability of levels of earthquake intensity at given sites in the Los Angeles and San Francisco areas of California. The method is applicable for decisions on optimizing the routing of aquedicts or other systems extending over large areas subject to seismic disturbance. (by N. K. Anderson and C. M. Duke). (3) An attenuation formula was derived for the Arias instrumental intensity on bedrock and con-Arias instrumental intensity on bestiock and con-stants in the formula were calibrated for the San Fernando earthquake (1971), using eight bedrock spectra derived from surface accelerograms. From the constant differences between four constrained the constant differences between four constrained attenuation curves, it is possible to define site factors to be applied to bedrock intensity in order to estimate surface intensity for zoning purposes. (by K. W. Campbell and C. M. Duke). (Snyder-Califor-W73-14204

GUIDE TO THE PREPARATION OF OPERA-TIONAL PLANS FOR SEWAGE TREATMENT FACILITIES.

Synectics Corp., Allison Park, Pa. For primary bibliographic entry see Field 05D.

THE ROLE OF URBAN ENGINEERING IN THE NATIONAL WATER POLICY ASSESSMENT, National Water Commission, Arlington, Va. Engineering and Environmental Sciences Div. For primary bibliographic entry see Field 06B. W73-14235

THE COMPUTER-SYSTEMS APPROACH TO ENVIRONMENTAL PROTECTION, PLANNING AND MANAGEMENT: THE MALIBU WATERSHED, California Univ., Los Angeles. School of Public Unclob.

Health. For primary bibliographic entry see Field 05B. W73-14371

# Techniques of Planning—Group 6A

FOR MANAGING REGIONAL WATER QUALITY, Harvard Univ., Cambridge, Mass. Harvard Water

For primary bibliographic entry see Field 05G. W73-14457

MICROECONOMIC BEHAVIOR WHEN SUP-PLIES ARE UNCERTAIN,

S.J. Turnovsky.

In: Models for Managing Regional Water Quality
(ed. by R. Dorfman, H.D. Jacoby, and H.A.
Thomas, Jr.), Harvard University Press, Cambridge, Mass., p 204-232 (Chapter 5), 1972. 2 fig, 23

Descriptors: "Economic analysis, "Decision making, "River basin commissions, "Water users, Behavior, "Water supply, Analytical techniques, Mathematical models, Prices, Consumptive use, Benefits, Stochastic processes, Design, Probability, Equations, Systems analysis, "Risks, "Resional analysis." al analysis

Identifiers: Public agencies, Micro-economic units, Production theory, Mean-variability analysis, Production function, Utility function.

In developing water resource projects, one must account for the inevitable fluctuation in system performance due to variation in streamflow, temperature, waste loads, equipment characteristics, and myriad other system inputs and parameters. Water users, in turn, respond to the level of uncertainty they experience, which affects the benefits tamity they experience, winch affects in benefits that are propertly credited to alternative plans. Fairlure to consider this phenomenon can lead to serious errors in system design and evaluation. This is the first of a pair of articles which considers the special problem of uncertainty as it affects the design and operating decisions made by public agencies. This article explores the behavior of micro-economic units--households and productive farms—when the supply of some input is sub-ject to uncertainty. A general, single-period model is developed which follows the mean-variability point of view and is essentially an extension of classical production (and consumption) theory.
Then turning to the consumer, a parallel model is developed where the notation that previously referred to inputs is interpreted as applying to con-sumption goods. (See also W73-14457 and W73-14463) (Bell-Cornell) W73-14462

OPTIMUM GOVERNMENT INVESTMENT IN SUPPLY SYSTEMS YIELDING UNCERTAIN

For primary bibliographic entry see Field 05G. W73-14463

ARTIFICIAL AERATION AS A SUBSTITUTE FOR WASTEWATER TREATMENT, For primary bibliographic entry see Field 05G. W73-14464

WASTEWATER CONVEYANCE MODELS, For primary bibliographic entry see Field 05G. W73-14465

THE SOCIO-ECONOMIC DIMENSION OF WATER MANAGEMENT, Battelle Memorial Inst., Columbus, Ohio. Regional Economics Div. D. C. Sweet.

D.C. Sweet.
In: 'Dimensions of Water Management,'
Proceedings of the 1st Annual Water Resources
Conference, March 24, 1970, Columbus, Ohio, p
12-20, (1970). 2 fig.

Descriptors: \*Optimum development plans, \*Social values, Economics, Planning, Cost-benefit analysis, Administration, Water resources, Value, Decision making, \*Management, Projections, Re-

gions, River basin development, Economic im-pact, Model studies. Identifiers: "Socio-economic impact, "Susquehan-na River Basin, "Water management model.

An ideal water management methodology is described in order to provide a theoretical basis for evaluation and design of working processor. The Susquehanna River Basin model, an example of a water management process based upon the ideal, is presented. The elements which comprise the ideal system include inventory and compilation of data describing the various socio-economic, of data describing the various socio-economic, physical and ecological characteristics of the area. Thus, a notion of primary demand on existing water resources may be derived and compared with their potential for supply. The definition process of the goals for the system includes establishment of the social and economic value of various water resources. Finally, both the short-and long-run socio-economic impact of accomplishment of the goals must be estimated and evaluated. Cost-benefit analysis must be employed in selection of possible alternative means of achievselection of possible alternative means of a ing the prescribed goals. The Susquehanna River Basin model developed in Battelle-Columbus is considered as one of the few models which relates socio-economic components to the physical com-ponents of a water resource planning area. (Weaver-Wisconsin)

DES MOINES METROPOLITAN SANITARY SEWERAGE SYSTEM STUDY: PART B-MAIN SEWAGE TREATMENT PLANT.
Veenstra and Kimm, West Des Moines, Iowa.

Central Iowa Regional Planning Commission, Des Moines, December 31, 1971. 111 p, 8 fig, 12 tab, 5

Descriptors: \*Planning, \*Sewage treatment, \*Treatment facilities, Waste treatment, Forecasting, Alternative planning, Iowa, Financing, Tertiary treatment, Waste water treatment. Identifiers: \*Des Moines (Iowa).

Expansion of the sewage treatment plant to handle flows from all or parts of the Des Moines, Iowa, metropolitan area was investigated. This is part of a long-range comprehensive plan for collection and treatment of wastes in the Des Moines metropolitan area and covers topics of: (1) state and federal regulations, (2) the existing treatment plant, giving both existing loadings and capabilities, (3) future loadings predicted by type and geographical area, (4) recommendations as to routing nd treatment of future loads, (5) alternative methods of providing additional treatment capaci-ty, (6) construction cost estimates, and (7) financing costs of construction and operation. The exist-ing plant was analyzed and found to be worth more than \$12 million with a replacement value of over \$20 million. It serves a population equivalent of the existing plant. (Poertner) W73-14529

COMPREHENSIVE WATER AND SEWER PLAN: FREDERICK COUNTY, MARYLAND, VOLUME I. Beavin Co., Baltimore, Md.

Frederick County Planning and Zoning Commission, Frederick, Maryland, 1969. 83 p.

Descriptors: "Planning, "Data collections, "Water supply, "Sewerage, Sewage treatment, Water treatment, Forecasting, Maryland, Comprehen-sive planning, Water resources development, Re-gional development, City planning, Identifiers: Frederick County (Maryland).

A comprehensive water and sewer plan was prepared for Frederick County, Maryland. Exist-ing systems were inventoried, projections were

made of probable future demands, and recommenmade of probable future demands, and recommendations for future systems are given. Total 1967 population was 92,100, and is expected to grow to 126,800 by 1980, 209,900 by the year 2000 and 2,127,000 by year 2070, at which time the county will be fully developed. The county has an area of about 670 square miles, of which approximately 34% is forest. Rainfall is about 42 inches a year, and is well distributed throughout the year. Water supplies are from the groundyager which is of and is well distributed infoughout the year. Water supplies are from the groundwater which is of good quality. Surface water is not used since streamflow is too dependent on rainfall. However, future development of water supplies calls for stream impoundments as well as further developstream impoundments as well as turtiner develop-ment of groundwater. A system of 20 water filtra-tion plants is recommended, with interconnections to form a country-wide system. In 1969, about 50 percent of Frederick County was served by sewers. Water quality in the Monocacy River below the sewage treatment plant is presently unsatisfactory. Besides this plant, other sources of pollution comes from farm animals. A country-wide system of 28 treatment plants if recomnended. Plants should remove at least 90 percent of the BOD; effluents should be used, rather than merely discharged; and animal sanitation should be improved. (Poertner) W73-14530

METROPOLITAN COMPREHENSIVE WATER, SEWAGE, AND SOLID WASTE PLANNING: VOLUME I-BACKGROUND. Bi-State Metropolitan Planning Commission, Rock

March, 1970, 139 p. 17 fig. 22 tab, 1 appendix.

Descriptors: \*Planning, \*Water supply, \*Sewerage, \*Sewage treatment, \*Solid wastes, Sewage treatment, Soild wastes, Comprehensive planning, Iowa, Illinois, Forecasting, Water resources development, Data collections, Regional development, City planning, Short-term planning, Long-term planning, Legal aspects, Geologic investigations.

A comprehesive inventory and analysis was made of water, sanitary sewerage, storm drainage and solid waste systems in the two-county, two-state planning region of the Bi-State Metropolitan Planning Commission. The region includes Scott County, Iowa and Rock Island County, Illinois. It County, Iowa and Rock Island County, Illinois. It covers 873 square miles and is bisected by the Mississippi River. Total population in 1967 was about 296,000 and is expected to increase to about 353,000 by 1985. This study covers the following topics: (1) an inventory of the existing facilities in every community in the planning area; (2) a determination of future utility needs; (3) an inventory of local geologic conditions; (4) an inventory of perinent federal, state, and local legislation; (5) an analysis of the existing facilities in light of future needs, geologic conditions, and present legislation; (6) preparation of a comprehensive 1985 plan based on the analysis; and (7) formulation of a short-range development program to implement based on the analysis; and (7) formulation of a short-range development program to implement the plan to 1975. This volume covers background material relevant to the study, including: (1) applicable state, federal and local laws, (2) federal agencies doing work in the subject areas, (3) federal grants-in-aid, (4) physical features in the study area, (5) methodology used for predicting future needs, (6) goals and objectives of the types of service studied. (Poertner) (See also W73-14532 and W73-14533) and W73-14533) W73-14531

METROPOLITAN COMPREHENSIVE WATER, SEWAGE, AND SOLID WASTE PLANNING STUDY: VOLUME II--INVENTORY ANALYSIS AND PLAN.
Bi-State Metropolitan Planning Commission, Rock

March, 1970. 323 p, 74 fig, 35 tab, 1 append.

# Field 06-WATER RESOURCES PLANNING

#### Group 6A-Techniques of Planning

Descriptors: \*Planning, \*Water supply, \*Sewerage, \*Sewage treatment, \*Solid wastes, Comprehensive planning, lova, Illinois, Forecasting, Water resources development, Data collections, Regional development, City planning, Short-term planning, Long-term planning, Legal aspects, Geologic investigations.

The Bi-State Metropolitan Planning Commission prepared this report to inventory and analyze existing water supplies, sanitary sewerage, storm drainage, and solid waste disposal. This report includes the following: (1) an inventory of the existing facilities in every community in the planning area: (2) a determination of future utility needs; (3) an inventory of local geologic conditions; (4) an inventory of pertinent federal, state, and local legislation; (5) an analysis of the existing facilities in light of future needs, geologic conditions, and present legislation; (6) preparation of a comprehensive 1985 plan based on the analysis; and (7) formulation of a short-range development program to implement the plan to 1975. This volume contains the inventory and analysis of existing systems and the plan for future systems. In 1967, the population of the 873 square mile region was about 296,000; by 1985 it is expected to grow to about 353,000. About 80 percent of all water comes from the Mississippi River and a problem is arising from the pollution by coliform bacteria, which has increased over 6 times from 1959 to 1964. It is recommended that existing water treatment plants be expanded to serve all areas within the central urbanized areas with water from the Mississippi River. Sanitary sewage facilities serve about 260,000 people, providing various levels of sewage treatment. Expansion of the service areas is recommended. Storm sewer plans call for separation of sewers in the large communities-the smaller communities are financially incapable of providing such sewers. Detailed study of solid waste problems is recommended. (Poertner) (See also W73-14531)

METROPOLITAN COMPREHENSIVE WATER, SEWAGE, AND SOLID WASTE PLANNING STUDY: VOLUME III--SHORT-RANGE DEVELOPMENT PROGRAM.
Bi-State Metropolitan Planning Commission, Rock Island III

March, 1970. 75 p, 35 tab.

Descriptors: \*Planning, \*Water supply, 
\*Sewerage, \*Sewage treatment, \*Solid wastes, 
Comprehensive planning, Iowa, Illinois, Forecasting, 
Water resources development, City planning, 
Regional development, Short-term planning, Legal 
aspects, Geologic investigations.

The Bi-State Metropolitan Planning Commission, prepared a study on an inventory, analysis and plans for water, sanitary sewerage, storm drainage, and solid waste management. This volume covers the short-range development plan of the program which included the following topics: (1) an inventory of the existing facilities in every community in the planning area; (2) a determination of future utility needs; (3) an inventory of pertinent federal, state, and local legislation; (5) an analysis of the existing facilities in light of future needs, geologic conditions, and present legislation; (6) preparation of a comprehensive 1985 plan based on the analysis; and (7) formulation of a short-range development program to implement he plan to 1975. The report is composed of three major sections: (1) financial resources available, including current revenues, methods of borrowing, grants-in-aid and other financial considerations; (2) specific program proposals for 1970-1975, covering 453 projects costing a total of \$83,146,000 (excluding solid waste management); and 1946,000 (excluding solid waste management); and recommendations. Two major concepts recom-

mended are: (1) enactment and enforcement of ordinances relative to the subject matter of this study, and (2) increased cooperation of local jurisdictions to solve common problems. (Poertner) (See also W73-14531) W73-14531

WELLESLEY -- A CASE STUDY OF THE WATER RESOURCE PROBLEMS OF A GROW-ING SUBURBAN MUNICIPALITY, Boston Univ., Mass. Dept. of Hydrogeology. D. S. Hunnewell. May 21, 1973. 40 p., 18 ref.

Descriptors: "Water resources development, "Forecasting, "Planning, "Water demand, "Water supply, Massachusetts, Water requirements, Dependable supply, Water shortage, Imported water, Political aspects, Institutions, Urbanization, Water contracts, Conservation. Identifiers: "Wellesley (Massachusetts), Boston (Massachusetts)

The Town of Wellesley, Massachusetts, is an example of a town faced with an impending water shortage. An earlier study by a professional engineering company recommended that Wellesley develop additional groundwater supplies rather than join the Metropolitan District Commission of Boston. However, the State Attorney General ruled that these groundwater supplies were previously unused by Wellesley, and therefore, under State law, could not be developed. Furthermore, the State Department of Public Health ruled that the proposed wells: (1) were too close to existing sewers, thereby risking contamination, and (2) would lower water levels in a river which already was being artificially augmented. The alternative—joining the MDC—is not without problems since the cost of water is \$120 per million gallons compared to the Wellesley rate of \$40 per million gallons and the MDC is also facing possible water shortages in the near future. Wellesley is currently served by 7 wells with a sustained yield of 6.1 mgd, with projected demands for 1990 ranging from 5.0-3. mgd for an average, and maximum daily demands of about 9.25-9.81 mgd. A local conservation group has been formed and is promoting the conservation of water both voluntarily and through changes in water rates. Another study suggests that State laws and regulations on water development within the MDC are antiquated and Wellesley should be allowed to develop the wells recommended in the engineering study. (Poertner) W73-14534

COMPREHENSIVE WATER AND WASTE-WATER PLAN, 1969. Baltimore City Dept. of Public Works, Md. Bureau of Engineering.

August 31, 1970, 86 p. 12 fig. 5 tab. 5 appendices.

Descriptors: \*Comprehensive planning, \*Water supply, \*Sewerage, \*Sewage treatment, Forecasting, Maryland, Water resources development, Water delivery, Water demand, Construction. Identifiers: \*Baltimore (Maryland).

A comprehensive water and wastewater plan was developed for the City of Baltimore to guide future development. Annual revisions of the plan are specified for presentation at public hearings, adoption by the mayor and city council, and approval by the State Health Department. The City of Baltimore derives its water from three surface sources-two reservoirs and the Susquehanna River. Three water treatment plants have a combined capacity of 360 mgd. Water distribution covers all of the City of Baltimore and parts of 3 adjacent counties, covering about 220 square miles. By the year 2000, it is estimated that the service area will cover about 700 square miles and will rely on increased water usage from the Susquehanna River. Recommended improvements

to 1977 total \$38,054,300, including \$12 million for improvements to water filtration plants and over \$19 million for improvements and extensions in water transmission mains. Pollution of Baltimore's waters is from 9 sources including: (1) commercial and industrial discharges, (2) septic tanks, (3) malfunctioning or inadequate treatment plants, (4) illegal sewer connections, (5) storm runoff, (6) marine craft, (7) leaching from dumps and landfills, and (8) natural sources. Significant commercial and industrial sources are known and efforts are being made to reduce this pollution. Other programs are directed against other forms of pollution, including upgrading of present treatment plants. (Poertner)

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REPORT ON REGIONAL WASTEWATER
TREATMENT FACILITIES FOR THE
FREDERICK METROPOLITAN AREA,
FREDERICK COUNTY, MARYLAND.
Baker-Wibberley and Associates, Inc.,
Hagerstown, Md.

Frederick County Metropolitan Commission, Frederick, Maryland, January 31, 1973. 36 p, 3 fig, 7 tab.

Descriptors: \*Planning, \*Sewage treatment, \*Treatment facilities, \*Regional development, Alternative planning, Maryland, Waste water treatment, Financing. Identifiers: \*Prederick County (Maryland).

Various methods of providing additional wastewater treatment capacity to the Frederick, Maryland metropolitan area were studied and evaluated. The Frederick metropolitan area is projected to experience rapid growth with the area reaching almost total development by year 2000. Population in 1970 was about 38,500 and is expected to reach 169,000 by 2010. Wastewater flows were about 5.35 mgd in 1970, and in 2010 flows are expected to be about 17.70 mgd. The present treatment plant serving the City of Frederick is expected to be used to total capacity within 5 to 10 years. Four alternate sites were examined for sewage treatment plants along the Monocacy River. On the basis of cost, the most economical site was chosen and the report recommends that land acquisition and design begin immediately. Treatment by the activated sludge process is recommended, along with sludge incineration. Cost of the system is estimated at \$5,881,000 (exclusive of land) for a plant capacity of 6.0 mgd, and federal and state grants of 87.5 percent of this cost are available. As an interim measure, it is recommended that suburban areas be allowed to hook up to the City of Frederick treatment plant. (Poertner)

AN ECONOMIC APPROACH FOR EVALUATING THE ADEQUACY OF HYDROLOGIC DATA,

DATA,
Queen's Univ., Kingston (Ontario).
For primary bibliographic entry see Field 02A.
W73-1455.

DESIGN OF HYDROMETRICAL NETWORKS AND APPLICATION TO COLOMBIA, World Meteorological Organization, Bogota (Colombia). For primary bibliographic entry see Field 02A. W73-14552

AN APPLICATION OF THE INADEQUATE HYDROLOGICAL DATA OF THE AFRICAN TROPICAL REGIONS IN ENGINEERING DESIGN, National Council for Scientific Research, Lusaka

National Council for Scientific Research, Lusaka (Zambia).
For primary bibliographic entry see Field 02A.

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#### WATER RESOURCES PLANNING-Field 06

Evaluation Process—Group 6B

IMPROVEMENT OF HYDROLOGICAL SER-VICES IN BOLIVIA,
World Meteorological Organization, La Paz

For primary bibliographic entry see Field 07A.
W73-14554

SHORT DURATION RAINFALL DEPTH-DUR-ATION-FREQUENCY MAP OF INDIA, Assam State Electricity Board, Barapani (India). For primary bibliographic entry see Field 02A. W73-14555

THE HYDROLOGICAL FEASIBILITY OF VARIABLE WATER SUPPLY POLICIES, Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div. For primary bibliographic entry see Field 02A. W73-14570

OPTIMAL POLICY FOR RESERV MANAGEMENT, McGill Univ., Montreal (Quebec). For primary bibliographic entry see Field 04A. W73-14666 PESEDVOID

BASIC CONCEPTS IN SYSTEM PLANNING OF

WATER RESOURCES,
Roorkee Univ. (India). Water Resources Development Training Centre. M. K. Singhal.

Indian Journal of Power and River Valley Development, Vol 23, No 2, p 36-38, February 1973, 1 fig. 5 ref.

Descriptors: \*Water resources, \*Planning, \*Systems analysis, \*Optimization, Simulation analysis, Storage, Dams, Reservoir releases, Economic efficiency, Linear programming, Decision making, Methodology, Computers, Analytical techniques, Mathematical models, \*Optimum development plans.

Man is confronted with the problem of planning in the face of increasingly limited resources. The concept of system planning provides a powerful tool for optimal planning of water resources. A system is defined as an integrated assembly of independent and interdependent components designed to carry out a predetermined function. The development of the systems approach is traced and its use illustrated by formulating a simplified mathematical model which uses linear programming and simulation analysis for hypothetical alonging of a storage dam. Types of mathematical gramming and simulation analysis for hypothetical planning of a storage dam. Types of mathematical models are discussed and the steps in system planning are outlined. The hypothetical planning problem is to determine the desirable storage and the target annual output reservoir release for achieving economic efficiency. (Bell-Cornell) W73-14667

EFFECTIVENESS OF THE OPTIMIZATION OF THE INPLANT REGIMENS OF HYDROELEC-TRIC PLANTS, For primary bibliographic entry see Field 08C. W73-14668

INVESTMENT CRITERIA AND MATHEMATI-CAL MODELLING TECHNIQUES FOR WATER RESOURCES PLANNING IN ARGENTINA: THE MIT-ARGENTINA PROJECT, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.

D. C. Major.
In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by International Federation of Automatic Control and the International Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 235-239, 1973. 2 fig, 11 ref.

Descriptors: \*Water resources, \*Planning,
\*Mathematical models, \*River basins, Irrigation, Descriptors: Water supply, Hydrologic models, Simulation analysis, Stochastic processes, Investment, Management, Economics, Research, Social aspects, Systems analysis.
Identifiers: \*Argentina, Rio Colorado, Power

production. Developing countries.

A research program at MIT for the application of modern investment criteria and mathematical modeling techniques for water resources planning in Argentina is described. The project lasted for two years and had three principal objectives: (1) To adapt modern water resources planning techniques to Argentina: (2) to train Argentine professionals in the use of these techniques; and (3) to apply the techniques to a basin in Argentina for the purpose of developing alternative manage-ment and development plans for the river responsive to alternative economic and social objectives. The key organizational features of the MIT-Argentina program are described; the nature of modern water resources planning methods is outlined, the two central elements being multiobjective planning and the combined use of mathematical programming models and hydrologic simulation programming modes and hydrologic amutation models. The basin selected for study is the Rio Colorado where present purposes of development are creating and enlarging irrigated zones and producing power. A description is presented of the system models used in the case study. Included are: A mathematical programming screening model to find configurations testable for hydrologic feasibility by the second model, a hydrologic simulation model; and a mixed integer 'sequencing' model utilizing the results of the first two models to develop the appropriate scheduling of hydrologically feasible projects over time. (Bell-Cornell)

CONSTRAINTS AND STRATEGIC CHOICES IN WATER SUPPLY INVESTMENT, Wye Coll., Ashford (England). School of Rural

W73-14670

Economics and Related Studies. I. D. Carruthers.

In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by Interna-tional Federation of Automatic Control and the International Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 225-234, 1973. 5 fig, 1 tab, 6 ref.

Descriptors: \*Water supply, \*Investment, \*Constraints, \*Management, \*Domestic water, \*Decision making, Rural areas, Systems analysis, Public utilities, Economics, Engineering.

Identifiers: \*Kenya (Africa), Developing countier Pecurus searchis.

tries Resource scarcity

Systems analysis appears to offer considerable operational value for the domestic water supply sector. This contention is examined in the context of the Kenya rural water program. Three aspects of the program are considered: (1) changes in the of the program are considered: (1) changes in the input mix; (2) changes in the process for installing and maintaining schemes; and (3) the requirements for feedback. It is concluded that the concepts, as well as the methods, of systems analysis would provide useful management input in a sector where technical engineering considerations tend to dominate decision making. It is found that special conditions obtain requiring more capital intensive methods, a new approach to budgeting, institu-tional evolution leading to a strong provincial organization, and a more comprehensive feedback of information to policy makers and management. (Bell-Cornell) W73-14671

GUIDELINES FOR SYSTEMS PLANNING IN-VESTIGATIONS AND OPTIMUM UTILIZA-

TION OF WATER RESOURCES AND NORMS IN A DEVELOPING AREA, Madhya Pradesh Government Control Board for Major Projects, Bhopal (India).

D D Cibba

D. R. Sikka.

In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by International Federation of Automatic Control and the International Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 463-465, 1973.

Descriptors: \*Water resources, \*Optimum development plans, \*Alternative planning, \*Systems analysis, River basins, Water utilization, Economics, Engineering, Management, Decision making, Mathematical models.

Identifiers: \*Developing countries, Power

In planning water resource projects in developing countries, it is necessary to account for the size and scope of the needs of the area. The planning involves a large number of choices, assumptions involves a large number of choices, assumptions and uncertainties in both engineering and economics; even after accounting for the technological constraints of topography and location, several alternative schemes of development with varying capacities and operating policies, technological features, and time streams of development are possibilities for meeting the various water derivative demands. These have to be considered in totality and in conjunction with power planning. Systems approach presents a variety of possible alternatives and their economic consequences, permitting optimal choice balanc-ing the interest of the individual states as well as the region as a whole. Objectives of a proposed water resources systems study are enumerated; input and system studies are listed; and river basin planning for optimum water use and supplies, and area size for water resource exploitation are discussed. Needed are: (1) clear quantification of a country's size and time factors of growth rate; (2) an integrated management authority; (3) development under short, medium and long-term mea-sures; (4) data collection and release programmes; and (5) development of surface and sub-surface waters according to time and finance limitations. for consumptive and non-consumptive uses. (Bell-Cornell) W73-14672

MODELLING TECHNIQUES FOR A SYSTEM ENGINEERING APPROACH OF THE PROBLEMS OF WATER USES FOR AGRICUL-TURAL PURPOSES,
Padua Univ. (Italy). Instituto di Elettrotecnica e di

Elettronica. For primary bibliographic entry see Field 08B. W73-14673

A SYSTEMS APPROACH TO SOLID WASTE MANAGEMENT IN ASIA: BANGKOK, THAI-LAND, AS A CASE STUDY, Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering. For primary bibliographic entry see Field 05D. W73-14674

#### 6B. Evaluation Process

A STUDY OF MANAGERIAL PRACTICES IN RURAL WATER SYSTEMS, University of Southern Mississippi, Hattiesburg.

University of Southern Mississippi, Hattiesburg. Bureau of Business Research. P. Cartee, and D. C. Williams, Jr. Available from the National Technical Information Service as PB-223 373, \$4.50 in paper copy, \$1.45 in microfiche. Mississippi State University, Mississippi State Water Resources Research Institute Report, July 1973. 125 p. 1 fig. 20 tab. 18 ref., 3 append. OWKR B-008-MISS (1).

# Field 06-WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

Descriptors: \*Management, Water supply, \*Rural areas, \*Mississippi, \*Water management (Applied), \*Operation and maintenance, Costs. Identifiers: \*Farmers Home Administration.

The rural community water system program of the Farmers' Home Administration was initiated in Mississippi in late 1962. The number of systems has grown until the total is now over 580, the second largest of all the states. Due to the rapid growth and the changing demands and standards placed on the systems, a study of the systems' managerial practices was deemed appropriate. Although many positive aspects were observed in the management of the systems, the emphasis was directed toward deficiencies in management. Specific deficiencies noted were: water operator qualifications and training: water quality surveilqualifications and training; water quality surveillance and lack of in-house testing programs; cross-connection prevention programs; inflated initial memberships used in determining system feasibili-ty; and lack of adequate internal business controls. Also of concern to this study were the relation of operating and maintenance costs per user to system size, the relation of contracted to in-house costs of operations and maintenance, and a case study of the effectiveness and efficiency of combining systems. W73-14208

SOCIOLOGICAL DIMENSIONS OF LEISURE INVOLVEMENT IN WATER-BASED RECREA-

TION, Washington Univ., Seattle. Coll. of Forest

Available from the National Technical Informa-tion Service as PB-223 349, \$3.50 in paper copy, \$1.45 in microfiche. Project Completion Report, July 1972, 43 p, 2 fig, 11 tab, 67 ref. OWRR A-047-WASH (2).

Descriptors: \*Social aspects, Methodology, \*Recreation demand, \*Attitudes, \*Behavior, \*So-cial participation, Motivation. Identifiers: \*Leisure, Social aggregate variables.

A baseline study was designed to identify essential sociological dimensions of participation in waterbased activities. Objectives were: (1) To identify social groups participating in water-based recrea-tion, as well as the social and economic charac-teristics of user-nonuser populations, (2) To identi-fy variation among social groups participating in specific water-based recreation activities, (3) To determine in what manner involvement in specific water-based recreation is complementary or diver-gent from involvement in other outdoor leisure pursuits, (4) To compare similarities and dif-ferences among water-based recreational users and nonusers in terms of involvement in general patterns of leisure behavior. While data about user-nonuser populations were scarce, the general relationship of differences in terms of socio-demographic characteristics continued to be valid. With graphic characteristics continued to be valid. With the wealth of data regarding participation, the question arose: why were predictive models of recreational demand misleading. The current research emphasis was shifted toward a systematic analysis of those factors associated with participation in a selected set of water-based activities wherein the results would have meaning for improving the predictive capabilities of models designed to measure recreation demand. W73-14211

THE VALUE OF INFORMATION IN MAKING PUBLIC DECISIONS, New Mexico Univ., Albuquerque. Dept. of

W. R. Porter.

Intermountain Economic Review, (1971). p 26-40, 1 fig, 3 tab, 9 ref. OWRR A-017-NMEX (1).

Descriptors: Model studies, \*Costs, Planning, \*Decision making, \*Cost benefit analysis, \*Benefits, Water resources development, Value.

Identifiers: Information value.

A viable and efficient sequential decision model was developed and tested which integrated information cost and stochastic benefits into the basic benefit-cost analysis for water resource project development. Given the very high costs of obtaining reliable estimates of benefits for water resource projects such a model could be very useful to constitute the statement of the cost of the statement of the stateme ful to government agencies wishing to get accurate benefit measurements but constrained by a limited budget for such information. W73-14228

THE ROLE OF URBAN ENGINEERING IN THE NATIONAL WATER POLICY ASSESSMENT, National Water Commission, Arlington, Va. Engineering and Environmental Sciences Div. A. B. Bigler, and J. E. Flack.

ber, 1971. 54 p, 2 append. OWRR A-013-

Descriptors: Engineering, \*Systems analysis, \*Water management, Model studies, Information exchange, Coordination. Identifiers: \*Interdisciplinary approach.

With the emergence of interdisciplinary approaches to help solve urban problems it has become necessary to clearly define the role of specific disciplines and the interrelationships among them. Engineering is basically responsible for physical-technological aspects of urban areas. Engineers have often been negligent of social and aesthetic issues but as members of a larger team looking at the total environment these problems can be overcome. As members of an interdisciplinary team, engineers would provide physical and operational criteria, alternative technical courses of action, and information on technological conof action, and information on technological con-sequences. The team would take a systems analysis approach but there is a great need for 'social engineering' skills to catch up with physical engineering and model building. A model for integrated urban water management is proposed which consists of two key features: a water resources advisory service which acts as a focal point for research and social information, and an point for research and social information, and an interdisciplinary team using a system analysis approach to plan an integrated water management system. (Elfers-North Carolina)
W73-14235

WATER QUALITY MANGEMENT PLAN FOR ALAMEDA CREEK WATERSHED ABOVE NILES.

Brown and Caldwell, San Francisco, Calif. For primary bibliographic entry see Field 05G. W73-14237

SHORELINE ANALYSIS OF THE CITY OF SARASOTA. Smally, Wellford and Nalven, Sarasota, Fla.

Prepared for the Tampa Bay Regional Planning Council, May, 1970. 149 p, 10 fig, 46 ref. HUD Florida P-109.

Descriptors: \*Shorelines, \*Aesthetics, \*Preserva-tion, Land use, Urbanization, Shore protection, Environmental effects, Controls, Regulations,

Identifiers: Shoreline preservation, \*Sarasota (Fla), Shoreline impact zones.

A planning background and framework is provided for the maintenance of the special character and attractiveness of the Sarasota shoreline. The reattractiveness of the Sarasota shoretine. The re-port is divided into three main parts: (1) a histori-cal sketch of the development of the shoreline area including natural physical processes, Indian settle-ments, and the most recent urbanization processes; (2) a comprehensive look at the trends in land use and water use of specific areas of the shoreline and the Bay; and (3) a presentation of concepts and possible controls for the future development of the area. The basic finding is that the quality of the shoreline at present is very good but that planning and guidance is necessary to maintain this state. Various concepts and regulations are proposed: (1) delineation of shoreline impact zones, i.e. the strip of land directly on the statement also additional trips attacking a faith. pact zones, i.e. the strip of land directly on the waterfront plus an adjacent strip extending a fairly short distance inland; (2) concept of visual access be elevated to approach a public right; (3) controls for boating uses; (4) planned use of dredging spoil to create public islands; (5) protection of the bay ecosystem with special attention to halting pollution; and (6) updating of city code to control construction. (Elfers-North Carolina) W73-14239

AREAWIDE COMPREHENSIVE WATER--SEWER PLAN, PART 2, PHASE I, 1970-1995, BREVARD COUNTY, FLORIDA. Brevard Engineering Co., Cape Canaveral, Fla. For primary bibliographic entry see Field 05G. W73-14241

URBAN SYSTEMS ENGINEERING DEMON-URBAN SYSTEMS ENGINEERING DEMON-STRATION PROGRAM, VOLUME V. CAPITAL IMPROVEMENTS PROGRAM, Diversified Consultants, Inc., Jackson, Miss. For primary bibliographic entry see Field 05G. W73-14242

PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON REMOTE SENSING IN ARID LANDS. Arizona Univ., Yucson. Office of Arid Lands Stu-

dies. For primary bibliographic entry see Field 07B. W73-14326

RESEARCH AND DEVELOPMENT IN INDUSTRIAL CORPORATIONS: CAN ADVANCED SOCIETIES LEARN TO CONTAIN POLLU-Minnesota Univ., Minneapolis. Dept. of Sociolo-

For primary bibliographic entry see Field 05G. W73-14365

THE GRAND TRAVERSE BAY SPORT FISHERY: ANGLER ACTIVITY, REVENUE, AND ECONOMIC IMPACT, Michigan Univ., Ann Arbor. School of Natural

N. Kapetsky, and J. R. Ryckman.
Available from NTIS, Springfield, Va 22151 as
COM-73-10462 - Price \$3.00 printed copy; \$1.45
microfiche. Michigan University Sea Grant
Technical Report No 34, January 1973. 32 p, 2 fig,
7 tab, 11 ref. MICHU-SG-B-201.

Descriptors: \*Sport fishing, \*Freshwater fish, \*Michigan, \*Bays, \*Economic impact, Water resources development, Recreation facilities, Tourism, Community development. Identifiers: \*Grand Traverse Bay (Mich).

Over a 1-year period, from May 1971 to May 1972, sport fishing activity in Grand Traverse Bay, Michigan, amounted to an estimated 69,000 angler days. Visitors to the area expended more than twothirds of total angler activity. An estimated \$418,000 of gross income attributable to the fishery resource accrued to the three-county community adjacent to the bay over the 1-year period, munity adjacent to the bay over the 1-year period, mostly from anglers using public launching sites and from charter fishermen. Net income to the community from sport fishing was estimated at \$203,000. Business activity generated by sport fishermen created an estimated 21.5 full-time equivalent jobs which were attributable to the fishery resource. Included in the community are Antrim, Grand Traverse, and Leelanau Counties,

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with a combined population of nearly 63,000 (U.S. Bureau of Census, 1970). Traverse City, at the southern end of the west arm of the bay, is the economic and cultural center of the community, with a population of about 18,000 (U.S. Bureau of with a population of about 18,000 (U.S. Bureau of Census, 1970). Tourism and recreation rank with manufacturing as leading economic activities in the region. (Woodard-USGS) W73-14409

PROBLEMS OF WATER RESOURCES USE AND CONSERVATION (PROBLEMY VOD-NYKH RESURSOV, IKH ISPOL'ZOVANIYA I OKHRANY), Institute of Geography of Siberia and the Far East,

Irkutsk. (USSR).

Institut Geografii Sibiri i Dal'nego Vostoka Doklady, No 26, p 61-69, Irkutsk, 1970. 18 ref.

Descriptors: \*Water resources, \*Water resources development, \*Water utilization, \*Water conser-Water management (Applied), Water storage. Identifiers: \*USSR, Hydrosphere.

Data are presented on water storage in different parts of the hydrosphere and on water consump-tion resulting from human economic activity. Spe-cial attention is given to problems relating to utilization of natural waters by different branches of the USSR national economy, and prospects of development of water management in the USSR and problems of water conservation are discussed. (Josefson-USGS) W73-14427

MUNICIPAL EVALUATION OF REGIONAL MANAGEMENT

WATER QUALITY MANAGEMENT PROPOSALS, Resources for the Future, Inc., Washington, D.C. For primary bibliographic entry see Field 05G. W73-14461

CONCEPTS FOR EFFECTIVE MANAGEMENT OF WATER QUALITY IN CONNECTICUT, Connecticut Dept. of Environmental Protection, Hartford. For primary bibliographic entry.see Field 05G.

SKETCH REGIONAL WATER AND SEWER Neuse River Regional Planning and Development

Council, New Bern, N.C. For primary bibliographic entry see Field 03D. W73-14488

STUDY DESIGN FOR A REGIONAL SEWER AND WATER PLAN.

Cuyahoga County Regional Planning Commission, Cleveland, Ohio. For primary bibliographic entry see Field 03D. W73-14489

PIGEON LAKE, PLANNING A RECREA-TIONAL RESOURCE.
Battle River Regional Planning Commission (Al-

December 1966. 27 p, 1 tab, 18 maps.

Descriptors: Recreation, \*Recreation facilities, \*Land use, \*Planning, \*Canada, Local govern-

Identifiers: \*Resort community, Development plan, Local government reorganization, Implementation, Battle River Region (Alberta), Wetaskin County (Alberta), \*Pigeon Lake (AlPigeon Lake, a 35.25 square mile spring fed area with a water shed extending an average of 3 miles back from shore, is approximately 40 miles southwest of Edmonton and within a one hour time/distance radius with a total population of 458,000 of which 405,000 is urban. As background for the proposals developed, the study outlines re-lated regional facilities including nearby lakes and means of access, existing land use area around the means of access, existing iand use area around the lake, density of current resort development along the edge, and the nature of existing land use con-trols. General principles of physical development are stated and a general recreational development plan is proposed, dealing with not only Pigeon Lake but also Battle and Wizard Lakes. Private and general public resort development is restricted to specific parts of the lakeshore, areas for wilderness recreational use are suggested, and much of the remaining shoreline would remain devoted of the remaining shoreine would remain devoted to agricultural uses. A secondary road network is layed out. Requirements for adequate implementa-tion of these proposals are explored with implica-tions for the form of local municipal organization tions for the form of local municipal organization and a request that the Provincial Department of Municipal Affairs critically appraise the establishment of a new system of resort community government. Specific recommendations and numerous maps are included. (Edwards-North Carolina) W73-14496

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM. Tulare County Planning Dept., Visalia, Calif. For primary bibliographic entry see Field 05G. W73-14497

WATER AND LIQUID WASTE MANAGEMENT: POLICIES, SYSTEMS PLANS, PROGRAM-

Tulare County Planning Dept., Visalia, Calif. For primary bibliographic entry see Field 05G. W73-14498

MASTER PLAN FOR STORM DRAINAGE: FORT WAYNE-NEW HAVEN-ALLEN COUNTY METROPOLITAN AREA. Schnelker (Philip L.), Inc., Fort Wayne, Ind.

Prepared for The Three Rivers Co-ordinating Council, April 1972. 174 p, 5 fig, 4 tab, 16 plates, 3 append. CPA-IN-05-00-0130.

Descriptors: \*Storm drains, \*Storm runoff, \*Rain-fall-runoff relationships, Forecasting, Rational method, Urbanization, Land use, Watersheds, Design criteria, Correlation analysis, \*Indiana. Identifiers: Allen County (Ind.), Fort Wayne (Ind.), New Haven (Ind.).

A plan is formulated for the construction and improvement of all necessary storm drainage systems in Allen County, Indiana. Storm drainage systems must be built far in advance of full urban development; they will help facilitate orderly development; they will neep tacintate orderly development. Focus is on forecasting future storm runoff, especially in relation to changing land use, and the engineering design of the systems. With re-gard to design criteria, such topics as runoff estimating methods, rainfall-runoff relationships, time of concentration criteria, and roughness coeffi-cients are discussed. A detailed presentation is included of the runoff forecasting procedure used for the small watersheds in the country. Three basic methods were used: (1) interpolation of flood-frequency analyses was used for gaged streams; (2) modification of the Rational Formula method was used for ungaged basins of 500 acres or less; and (3) a Correlation Method, developed for the study, was used for basins over 500 acres. In the last two methods the key parameters used for local modification were drainage area, length of prin-cipal channel, vertical fall of principal channel, vertical fall of principal channel, soil type, and projected land use. (Elfers-North Carolina)

W73-14500

OBION AND FORKED DEER RIVERS AND TRIBUTARIES, TENNESSEE AND KENTUCKY, INTERIM REPORT: HARRIS FORK CREEK. Army Engineer District, Memphis, Tenn. For primary bibliographic entry see Field 04A. W73-14502

EXTENDING THE ST. LAWRENCE SEAWAY NAVIGATION SEASON: THE COST-BENEFIT APPROACH, Wisconsin Univ., Milwaukee. Dept. of

Economics.

Descriptors: \*St. Lawrence Seaway, \*Navigation, \*Cost-benefit analysis, \*Ice, Technology, Economic impact, Transportation, Economic effi-Identifiers: \*Navigation season extension,

Winter close-down prevents the St. Lawrence Seaway from realizing its true potential as a full service, low cost transportation route. Such close-downs weaken the Seaway's competitive position with overland-seaboard routes used as alternatives. A cost-benefit analysis, based on available data, of the possible extension of the operating season for two, four, and six weeks is presented. Coast Guard estimates of cost for season extendents. Coast Guard estimates of costs for season exten-sion are employed because of their separation of ice breaking costs, construction costs, and in-creased annual costs. Estimated economic creased annual costs. Estimated economic benefits include: cost savings for present traffic, the increased regional income due to new traffic, impact of diverted traffic, and the savings on the stockpiling of bulk cargo not shipped during the winter close-down. A four week extension was found to be the minimum necessary to generate significant transportation savings, although longer extensions are also economically justified. (Weaver-Wisconsin) W73-14508

EFFECTS OF FISHING AND HUNTING EXPENDITURES ON A LOCAL COLORADO ECONO-

MY,
Montana Univ., Missoula. School of Forestry.
R. E. Lovegrove, and D. D. Rohdy.
The Annals of Regional Science, Vol 6, No 2, p

Descriptors: \*Economic impact, \*Recreation, \*Fishing, \*Hunting, Regional economics, Model studies, Input-output analysis, Income analysis, Evaluation, \*Colorado. Identifiers: Game management, \*Grand County (Colo.), Multiplier estimation, Impact optimization.

In order to both satisfy ever increasing demand for fishing and hunting and maximize economic impact of these activities, fish and game authorities must determine efficient expenditure schemes based on knowledge of the specific economic impacts of alternative public expenditures. The recreational impact is evaluated using a three-phase methodology based on data compiled from Grand County, Colorado. The methodology includes: (1) construction of an interindustry model of the country for 1968. (2) estimation of expenditures. cludes: (1) construction of an interindustry model of the country for 1968, (2) estimation of expenditures directly related to the pursuit of the sport (s), and (3) estimation of the total economic impact through consideration of both (1) and (2). Income multipliers were derived from the interindustry model. Results from mail questionnaires led to the estimation of sportsmen expenditures which indicated that fishermen, in aggregate, spent nearly eight times as much as hunters. Final analysis indicates that fishing accounted for 11.1% and hunting 1.4% of total economic activity in the county and that jointly they generated 21% of total direct, indirect, and induced household income. (Weaver-Wisconsin)

### Field 06-WATER RESOURCES PLANNING

#### Group 6B-Evaluation Process

W73-14509

CLUSTER ANALYSIS AND WATER PROJECT EVALUATION, South Dakota State Univ., Brookings. Dept. of Economics. J. E. Wiebe.

Water Resources Bulletin, Vol 8, No 6, p 1189-1197, 1972, 10 fig, 1 tab, 2 ref.

Descriptors: "Project benefits, "Welfare (Economics), "Evaluation, Regional economics, Economic impact, "Tennessee River, Income, Employment, Water resources development. Identifiers: \*Cluster analysis.

Large-scale water projects are designed to generate positive economic and social benefits at their site. This study tested the hypothesis that in-come and employment benefits would be positiveby related to the areas where the projects were located. The research area was a 120-county region of the Tennessee River Watershed in the geographic location of the Tennessee Valley Authority. Cluster analysis was used to delineate counties in the watershed on the basis of changes in selected variables over time, weighted and divided for analysis into ten different combinations; these for analysis into ten different combinations, these included 'Per capita income,' 'Total income,' 'Total employment,' 'Capital invested in manufacturing,' 'Percentage total population 25 years old and over with no school,' 'Percentage total population 25 years old and over with at least one year of college disease and the state.' of college education, and 'Percentage population in income category of \$7000 and over.' Conclusions indicate that economic benefits can be assummed to be regional and not pronounced in counties adjacent to TVA. (Weaver-Wisconsin) W73-14510

POLLUTION IN A NEO-CLASSICAL WORLD. -THE CLASSICS REHABILITATED, For primary bibliographic entry see Field 05G. W73-14513

ECONOMIC EVALUATION OF SPORT FISHE-RIES-WHAT DO THEY MEAN, Slaney (F. F.) and Co. Ltd., Vancouver (British

Columbia). D. Gordon, D. W. Chapman, and T. C. Bjornn. Transactions of American Fisheries Society, Vol 102, No 2, p 293-311, 1973. 4 fig, 13 tab, 23 ref.

Descriptors: \*Recreation, \*Fishing, \*Value, \*Economic impact, \*Idaho, Decision making, Welfare (Economics), Resource allocation Evaluation, Social values, Analytical techniques. Identifiers: Demand estimation, Consumer sur-

Techniques for valuation of sport fisheries were reviewed, compared and evaluated using a 1968 survey of anglers in Idaho. Based on the survey, the following measures of economic impact were estimated; (1) gross annual expenditures by sport fishermen, (2) net value and consumer surplus of various high quality sport fishery resources in Idaho, and (3) distribution of resident and non-resident fishing effort in the state. The survey pro-vided daily expenditures and total days fished from which transfer costs spent by anglers were estimated, and demand curves simulated for eight fisheries in Idaho. On the basis of these curves maximum revenue (net value) and consumer surplus at the optimum daily angler fee were esti-mated. Results indicate a total net value of approx-imately \$4.7 million and consumer surplus of \$9.4 million associated with the eight fisheries. Com-parison of techniques and results of the present study to others success that one of the present study to others suggests that more consistent procedures would improve comparability of results. Although resource value was found to be unsatisfactorily estimated by gross expenditures, capitalized values may be useful. User-oriented orth of a fishery if were owned and marketed by

a monopolist were approximated by estimates of net worth. (Weaver-Wisconsin) W73-14514

A RATIONALE FOR THE REGIONALIZATION OF PUBLIC WATER SYSTEMS, Environmental Protection Agency, Washington,

D.C. Div. of Water Supply. K. A. Boyd, and F. A. Bell, Jr.

Water Resources Bulletin, Vol 9, No 1, p 73-80, 1973. 1 fig. 3 tab, 18 ref.

Descriptors: \*Water works, \*Potable water, \*Consolidation, \*Economic efficiency, Regions, Water rates, Public utilities, Legislation, Water delivery, Water quality standards, Cost analysis, Public health, \*Regional analysis. Identifiers: Small water utilities, Water service.

Studies of community water supply systems indicate that small systems have significantly more problems in their construction, operation, and in achievement of national Drinking Water Standards than do larger systems. The problem of analysing the economics of water service was simplified by studying costs of service, divided into person costs and capital costs, and water service rates for five example systems. In so doing, a rationale is set forth for requiring and/or encouraging the con-solidation or regionalization of all systems serving populations beneath certain sizes. Minimal population sizes would be determined based on the small water systems' capability to produce an adequate supply of safe drinking water at reasonable cost. Estimates of basic costs and a range of water rates, thought to be acceptable to the customer, are used to determine public water system sizes which might be expected to achieve fiscal viability. Policy recommendations include both state and federal review of the extent and severity of small public water system problems and their resolution through consolidation or regionalization. (Weaver-Wisconsin) W73-14515

WATER FOR THE FUTURE,

Ohio Agricultural Research and Development Center, Wooster.

T. L. Napier. Ohio Report, Vol 58, No 2, p 57-59, 1973. 3 tab.

Descriptors: \*Water resources development, \*Sites, \*Relocation, \*Population, \*Rural sociology, Social aspects, Social adjustment, Social impact, \*Ohio, \*West Virginia, Impoundments, Water supply, \*Social impact. Identifiers: Social attitudes, Social alienation, Watershed development.

The social-psychological impact of the expansion of water impoundments and subsequent population relocation upon rural community groups in Ohio and West Virginia were studied. The specific hypothesis tested stated that watershed development resulted in an alienated population. Four communities, carefully chosen to ensure comparability of the community groups, were sampled on a systematic random sample basis. An alienation attitudinal scale was constructed and pre-tested. The scale consisted of 21 Likert-type items intended to measure the affected groups' attitudes toward community leadership, other people in the group, personal estrangement from the community and basic satisfaction with the community. The results indicated that watershed development did not destroy people's perception of their community. However, physical displacement and subsequent community disruption leads to negative attitudes. (Weaver-Wisconsin) W73-14520

FUTURE ALLOCATIONS OF LAND AND WATER: IMPLICATIONS FOR AGRICUL-TURAL AND WATER POLICIES, Iowa State Univ., Ames. Center for Agricultural and Rural Development.
For primary bibliographic entry see Field 06D.

U.S. DEEPWATER PORT STUDY. VOL. 1. SUM-MARY AND CONCLUSIONS, Nathan (Robert R.) Associates, Inc., Washington,

R. L. Trisko, P. Cheney, J. de Rover, J. C. Vlin,

Available from the National Technical Informa-tion Service as AD-750 090, \$4.85 in paper copy, \$1.45 in microfiche. Army Engineer Institute for Water Resources, Alexandria, Virginia, Final Re-port IWR 72-8, August 1972. 74 p, 4 tab. DACW 31-71-C-0045.

Descriptors: "Environmental effects, "Harbors, "Ships, "Economics, "Oil, Offshore platforms, Channels, Navigable waters, Transportation, Ecology, Dredging, Economics of scale, Cost-benefit ratio, Foreign trade, Oil spills, Wetlands, Costs, Decision making, Risks, Design criteria, Benefit-cost analysis.

Identifiers: "Deep-draft shipping, "Supercarriers, Dry bulk trade, Refineries, Crude petroleum, Water transshipment, Secondary economic effects.

fects

The findings of an examination of the need for deep water ports and alternatives to accommodate deep-draft ships in U.S. trade are summarized. Benefits and costs of the alternatives are estimated based on consideration of their engineering, environmental and economic characteristics. Petroleum was found to dominate bulk commodities requiring extensive deepwater facilities in the future. Savings in transportation costs indicated that, in economic terms, the cost of developing alternative deepwater terminals would be justified. Offshore facilities located advantageously with respect to areas of high demand and to existing or feasible refinery areas are shown to be economic cally and environmentally preferable to channel dredging at existing terminals. Determination of optimal locations and capacities of deepwater ports is subject to uncertainities regarding s ports is subject to uncertainties regarding specific requirements for additional refinery capacity. The potential economics of adapting ship sizes to chan-nel condition by increasing capacity without in-creasing draft is emphasized. Deepwater trans-shipment ports on the East and Gulf Coasts for dry bulk goods seem economically unfeasible. Action on petroleum ports is urged, but is dependent on the establishment of an institutional mechanism to coordinate effective planning, design and control of their development and operation to eliminate or minimize environmental and ecological damage. (Weaver-Wisconsin) W73-14524

THE LITANY OF SCARCITY VERSUS THE CHALLENGE OF ABUNDANCE, Montana Univ., Missoula. School of Forestry.

R. W. Behan. Journal of Soil and Water Conservation, Vol 28, No 2, p 50-51, 1973.

Descriptors: \*Natural resources, \*Food abudance, \*Human population, Supply, Demand.

Traditional conceptions of natural resources based upon the belief that resources are a fixed inventoupon the belief that resources are a fixed inventory which could never adequately supply the world's ever growing population, that science and technology are agents of environmental degradation and that the standard of living is simply the ratio of fixed resources to growing population are refuted. First, history has shown the Malthus prediction to be the reverse of the reality-that productivity has increased geometrically while popul create the ar compl

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population has only increased arithmetically and in many cases has stabilized. Secondly, technology is the set of value-neutral methods by which man choosen to transform resources to serve his needs. choosen to transform resources to serve his needs. Finally, resources are not fixed inventories, but are a functional concept related to physical substance, utility perceived in the substanceand technology. Thus, resources as functional concept are not inherently limited and in place of a litany of scarcity we should recognize the challenge of abudance. This challenge involves making necessary changes such that abudance may be achieved and when achieved, properly distributed. (Weaver-Wisconsin) Wisconsin) W73-14527

RESOURCES FOR THE FUTURE, ANNUAL RE-PORT, FOR THE YEAR ENDING SEPTEMBER 30, 1972.

Resources for the Future, Inc., Washington, D.C.

(1972), 123 p.

Descriptors: \*Environment, \*Long-term planning, Social aspects, Human population, Energy, \*Natural resources, \*Human resources. Identifiers: Resource adequacy, Energy crisis, Pollution, Demography, Resource availability, Energy consumption.

In addition to the year's accomplishments and the financial status of Resources for the Future, Inc, an essay by Joseph L. Fisher and two special articles are presented. The essay examines the dichotomy of interests held by environmentalists and those examines the second of the essay of the and those concerned with poverty. The issues are, in fact, interrelated and present common areas for amelioration. The first special article is based on recent RFF studies concerning energy and voices the need for a long-range, comprehensive set of national energy policies in order to divert a possibly impending energy crisis. The question of the relative importance of population growth as compared with economic growth, various forms of technology, and patterns of comsumption and their specific implications for pollution and resource availability are considered. Results indicate that population growth will have significant effects on resource adequacy, environmental quality and consequently, maintenance of the present way of life. Review of the year's work underscored the critical importance of energy consumption and its relation to environmental quality and a wide range of social and economic problems which can only hope to be solved with new methods of policy formulation. (Weaver-Wisconsin) W73-14528

DECISION-MAKING IN WATER RESOURCE

DECISION-MAKING IN WATER RESOURCE ALLOCATION, Oregon State Univ., Corvallis. C. Brown, J. G. Monks, and J. R. Park. D. C. Heath and Co., Lexington, Massachusetts, 1973, 111 p. Price \$10.00. OWRR B-016-ORE (3).

Descriptors: \*Decision making, \*Watershed management, Social aspects, Political aspects, Economics, Benefits, \*Oregon, \*Water allocation

Identifiers: Junction City (Ore), Willamette Valley

The Junction City project, or more correctly the Amazon Flat Creek Watershed development, was chosen, because it contained all levels of government participation and involved a degree of democratic input into the decision by the general populace. A local agency of government was created to administer and to manage the project. It was necessary to submit a tax base to the voters of was necessary to submit a tan base to the voters of the area, and therefore an election was held. This complete process from the local elections to gain local approval through the administrative processes of a bureaucratic system into the political content of the politic

cal system of the Congress provided an excellent vehicle for the study of decision-making in a compact situation. Very few persons actually par-ticipated in the decision process even though the democratic process provided them the legal right to do so. The information flow by those in authority and control did not permit appropriate develop-ment of opposition until it essentially became too late for such opposition to be effective. The legal late for such opposition to be effective. The legal channels of communication are inadequate even when they are supplemented by news stories and public hearings. Residents within the water control district perceive that a specific category of people is receiving the most benefit from the project. Understanding the nature of a public good and identifying advocates were found to be fruitful approaches to this study. The Junction City project was initiated as a flood control and drainage project, but when the concept of irrigation was introduced, some people began to look at the potential gain resulting from irritation more than at the potential loss resulting from floods and standing ground water. The local administrative unit (that is, the water control district) is composed of residents who act as directors but do not necessarily see themselves as government officials. The name see themselves as government officials. The name of the local administrative unit was misleading to many residents. W73-14619

STUDENT PROJECTS ON COASTAL ZONE AND OFFSHORE RESOURCES MANAGE-

MENT, Massachusetts Inst. of Tech., Cambridge. For primary bibliographic entry see Field 02L. W73-14615

A SYSTEMS APPROACH TO ASSESSMENT OF RURAL WATER SUPPLY PROGRAM EFFEC-

Asian Inst. of Tech., Bangkok (Thailand). Dept. of **Environmental Engineering** 

In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by Interna-tional Federation of Automatic Control and the International Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 241-246, 1973. 2 fig, 3 tab.

Descriptors: \*Rural areas, \*Water supply, \*Evaluation, \*Systems analysis, Methodology, Constraints, Resource allocation, Economics, So-\*Water supply,

cial aspects, Data collections.
Identifiers: \*Effectiveness, \*Developing countries, \*Thailand, Scare resources, Information, Impact evaluation

Methodology was developed to evaluate the effectiveness of Thailand's effort in providing potable water to rural communities and to demonstrate the improvements in impact evaluation made possible through application of systems analysis. Just as through application of systems analysis. Just as feasibility studies are necessary to evaluate the technical and economic acceptability of proposed projects, so are impact studies necessary to assess the economic and social effects of projects already undertaken. In Thailand, an impact evaluation was undertaken to analyze the effectiveness of the National Potable Water Project and to provide feedback to the government for improving the administrative, technical and operational aspects of the program. The methodology developed measured the social, economic and public health implications of the water projects towards achieving rural community development. The evaluation ad-dressed the broad issues of whether the water gressed the broad issues of whether the water systems have: (1) had a positive effect on community attitudes towards the local and central governments; (2) fostered economic growth; and (3) had a significant positive effect on water use habits and on the overall level of community health. Data are being collected from some 165 village projects throughout northeast Thailand. (Bell-Cornell) W73-14669 GUIDELINES FOR SYSTEMS PLANNING IN-VESTIGATIONS AND OPTIMUM UTILIZA-TION OF WATER RESOURCES AND NORMS IN A DEVELOPING AREA, Madhya Pradesh Government Control Board for Major Projects, Bhopal (India). For primary bibliographic entry see Field 06A. W73-14672

WATER RESOURCES IN SANTA CLARA COUNTY: A PLAN FOR CONSERVATION, For primary bibliographic entry see Field 03D. W73-14675

RIVERFRONT DEVELOPMENT PLAN, CON-NECTICUT RIVER, SPRINGFIELD, MAS-SACHUSETTS.
Springfield Planning Dept., Mass.
For primary bibliographic entry see Field 03D.
W73-14676

RIVERBANKS IMPROVEMENT PROGRAM, (BROOME AND TIOGA COUNTIES, N.Y.).
Broome County Planning Dept., Binghamton, N.Y.; and Southern Tier East Regional Planning Board, Binghamton, N.Y.
For primary bibliographic entry see Field 03D.
W73-14678

HOWARD COUNTY, INDIANA: COMPREHEN-SIVE WATER AND SEWER PLAN. Hamilton (Ernest R.) Associates, Inc., Indianapolis, Ind. For primary bibliographic entry see Field 03D. W73-14680

STUDY OF THE CINCINNATI RIVERFRONT -PART I: REGIONAL ASPECTS.
Cincinnati Planning Commission, Ohio.

October, 1969, 16 p. 2 fig. 5 tab, 16 append.

Descriptors: \*Regional development, \*Recreation demand, Rivers, Land use, Flood plains, Projections, \*Ohio River. Identifiers: \*Riverfronts, \*Regional economy, \*Land use suitability, Waterborne commerce,

The Cincinnati regional riverfront is defined as a 45 mile reach of the Ohio River from Lawrenceburg, Indiana to New Richmond, Ohio. The study focuses on the economy of the area, where the population is expected to increase by 20% between 1960 and 1980; on waterborne commerce, with changing patterns in shipping reflected in fewer coal-coke terminals and more terminals devoted to oil-gasoline products, and chemicals; on industrial expansion devoted chiefly to power plants, iron and steel manufacture, atomic energy installations and gas and electric utilities; on land uses in riverfront area; and on the rapidly increasing demands for recreation. Much of the data presented is based on U. S. Army Corps of Engineers reports and previous Planning Commission studies. A key feature of the study is a land use suitability analysis in which various areas of the riverfront region are ranked on the basis of accessibility. flood plain levels, and relationships between land uses. Some basic conclusions are that the region will grow economically at a nominal rate until 1980, that there is a large amount of vacant land available but much of it is not suitable because of lack of access or potential flooding, and that recreation demands are becomflooding, and that recreation demands are becoming a significance force in the development of the region with needs for future harbor and launching facilities for pleasure craft becoming increasingly evident. (Elfers-North Carolina) W73-14681

### Field 06-WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

WATER AND WASTEWATER PLAN FOR ANDERSON, BLOUNT, AND KNOX COUNTIES, TENNESSEE - VOLUME I, WATER SUPPLY AND DISTRIBUTION.
Allen and Hoshall, Memphis, Tenn.
For primary bibliographic entry see Field 05G.
W73-14682

WATER AND WASTEWATER PLAN FOR AN-WAJER AND WASTEWATER PLAN FOR AN-DERSON, BLOUNT, AND KNOX COUNTIES, TENNESSEE - VOLUME II, WASTEWATER COLLECTION AND TREATMENT. Allen and Hoshall, Memphis, Tenn. For primary bibliographic entry see Field 05G. W73-14683

THE URBAN RIVER: A STAFF PROPOSAL FOR WATERPRONT DEVELOPMENT IN THE DISTRICT OF COLUMBIA.
National Capital Planning Commission, Washing-

ton, D.C. For primary bibliographic entry see Field 03D.

#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A STUDY OF MANAGERIAL PRACTICES IN RURAL WATER SYSTEMS, University of Southern Mississippi, Hattiesburg. Bureau of Business Research.
For primary bibliographic entry see Field 06B.

ELECTRICAL POWER CONSUMPTION FOR MUNICIPAL WASTEWATER TREATMENT, National Environmental Research Center, Cincinnati, Ohio. Advance Waste Treatment Research

For primary bibliographic entry see Field 05D. W73-14216

THE VALUE OF INFORMATION IN MAKING

PUBLIC DECISIONS, New Mexico Univ., Albuquerque. Dept. of For primary bibliographic entry see Field 06B.

MATHEMATICAL SIMULATION OF

MONIA STRIPPING TOWERS FOR WASTE-WATER TREATMENT, Federal Water Quality Administration, Cincinnati, Ohio, Advanced Waste Treatment Research Lab. For primary bibliographic entry see Field 05D. W73-14229

CONCEPTUAL DESIGN AND COST ESTIMATE 5 MGD DIRECT CONTACT CONDENSATION MULTISTAGE FLASH DESALINATION PLANT.

For primary bibliographic entry see Field 03A. W73-14385

THE GRAND TRAVERSE BAY SPORT FISHERY: ANGLER ACTIVITY, REVENUE, AND ECONOMIC IMPACT, Michigan Univ., Ann Arbor. School of Natural For primary bibliographic entry see Field 06B. W73-14409

LAB AUTOMATION AT LOW COST, Digital Equipment Corp., Maynard, Mass. Lab. Data Products Group. For primary bibliographic entry see Field 07C. W73-14451

EXTERNALITIES, FACTOR PROPORTIONS AND THE LEVEL OF EXPLOITATION OF FREE ACCESS RESOURCES, London School of Economics and Political

Science (England). J. R. Gould.

Economica, Vol 39, No 156, p 383-402, 1972. 8 fig.

Descriptors: \*Economic efficiency, \*Resource allocation, Model studies, \*Theoretical analysis, Industries, Welfare (Economics).

Identifiers: \*Free-access resources, \*Externali-ties, Factor proportions, Resource utilization.

The doctrine that free-access resources are over-exploited finds its theoretical foundation in the work of Pigou and Knight during the 1920's. Knight's analysis of the single variable factor is discussed and further elaborated in order to render the model logically consistent and easy to manipu-late as well as to confirm Knight's doctrine that free-access resources are over-exploited. Next, the model is extended to include two variable factors making it necessary to consider the problem of efficient factor proportions. As a result of inef-ficient factor proportions the over-exploitation theorem is invalidated. Thus, free-access interior is invandated. I has, tree-access resources may be over- or under-exploited, and accordingly, increasing-cost industries may be over- or under-expanded. The case of increasing returns to variable factors, as analysed by Worcester, is compared with Knight's model. Wor-cester's assumption of indivisibility of the resource leads to a straightforward prescription of subsidy which does not follow from the assump-tion of divisibility as in the case of Knight's model. (Weaver-Wisconsin) W73-14507

A NEW CONCEPT FOR OPERATOR WAGES, Water Pollution Control Federation, Washington, D.C.

For primary bibliographic entry see Field 05D. W73-14511

IMPLICATIONS OF PLLRC TAX RECOMMEN-DATIONS FOR FEDERAL HYDRO PROJECTS AND POWER FACILITIES,

Tennessee Valley Authority, Knoxville. Div. of Navigation Development and Regional Studies. For primary bibliographic entry see Field 06E. W73-14512

THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES: LEAD. PART I. INTRODUCTION AND EXECU-TIVE SUMMARY.

Charles River Associates, Inc., Cambridge, Mass. For primary bibliographic entry see Field 05G. W73-14516

THE EFFECTS OF POLLUTION CONTROL ON THE NONFERROUS METALS INDUSTRIES: LEAD. PART II. STRUCTURE OF THE INDUS-TRY

Charles River Associates, Inc., Cambridge, Mass. For primary bibliographic entry see Field 05G. W73-14517

PRICETAG TO INDUSTRY, Hazen and Sawyer, New York. For primary bibliographic entry see Field 05D.

DESIGN FOR FUTURE PROGRAM CON-STRUCTION, Washington State Dept. of Fisheries, Olympia. Engineering and Construction Div. For primary bibliographic entry see Field 081. W73-14522

ECONOMIC ASPECTS OF SLOPING LAND DRAINAGE, Agricultural Research Service, Burlington, Vt.

Water Conservation Research Div. For primary bibliographic entry see Field 04A. W73-14523

WATER QUALITY AND CONSUMER COSTS. Orange County Water District, Santa Ana, Calif.

May, 1972. 73 p, 13 fig, 17 tab, 24 ref.

Descriptors: \*Water quality, \*Water values, \*Water utilization, \*Data collections, Public benefits, Water users, California, Impaired water wase, Potable water, Water distribution (Applied), Water supply, Water softening.

Identifiers: \*Orange County (California).

Domestic water users were surveyed by the Orange County Water District and mine water purveying agencies in Orange County to determine the relationships between water quality and related consumer costs. Water quality varied from poor quality water from the Colorado River to high quality ground water. House values included in the survey ranged from below \$20,000 to above survey ranged from below \$20,000 to above \$50,000. The survey was performed by personal interviews, with families picked from the telephone directory in 40 sampling areas. A total of 1,193 interviews were conducted in 16 cities. Questions were asked relative to: (1) the use of bottled water, (2) replacement of water heaters, (3) use of water softeners, (4) replacement of water piping, (5) occurrence of water damage in homes, (6) satisfaction with present water characteristics, and (7) willingness to pay for better water quality. These questions, and others, were correlated to water quality. Colorado River water, with a total dissolved solid (TDS) concentration of about 746 mg/1, imposes a cost of from \$10 to \$17 per household per month over expected State Water Project water which should have a TDS of 199 mg/1. (Poertner) W73-14536

INVESTMENT CRITERIA AND MATHEMATI-CAL MODELLING TECHNIQUES FOR WATER RESOURCES PLANNING IN ARGENTINA: THE MIT-ARGENTINA PROJECT.

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A. W73-14670

CONSTRAINTS AND STRATEGIC CHOICES IN WATER SUPPLY INVESTMENT, Wye Coll., Ashford (England). School of Rural Economics and Related Studies. For primary bibliographic entry see Field 06A. W73-14671

#### 6D. Water Demand

SOCIOLOGICAL DIMENSIONS OF LEISURE INVOLVEMENT IN WATER-BASED RECREA-TION, Washington Univ., Seattle. Coll. of Forest

Resources. For primary bibliographic entry see Field 06B. W73-14211

FUTURE MUNICIPAL AND INDUSTRIAL WATER REQUIREMENTS IN THE QU'AP-PELLE RIVER BASIN.
Saskatchewan Water Resources Commission,

Regina. Investigation and Planning Branch.

Qu'Appelle Basin Study, Item 230, April, 1972. 68 p, 1 fig, 53 tab, append.

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LOOK Geolog Resour C. R. M Journa tion, V tab, 11

Descrip Water \*United nicipal resourc Descriptors: "Water supply, "Water requirements, Withdrawal, Projections, Consumptive use, Municipal water, Industrial water, "Canada. Identifiers: "Qu'Appelle River Basin, Regina, Moose Jaw, Melville, Saskatchewan.

Future water withdrawals in the Qu'Appelle River Future water withdrawals in the Qu'Appelle River basin are expected to decrease significantly by the year 2000 because of the expected phasing out of the Regina power plant after 1985. Municipal water requirements are expected to rise during this period and account for 88.5% of the basin, Regina, Moose Jaw, and Melville, will account for about 90% of the municipal requirements. Detailed water requirement data for these three cities and twenty-three towns, which are expected to grow, are presented in numerous tables. Water requireare presented in numerous tables. Water requirements are estimated for industries having their own water supplies. Municipal water supply requirements are estimated on the basis of population projections and an assumed increase of one gallon per capita per day for each year from 1970 to 2000. (Elfers-North Carolina)

WATER DISTRIBUTION AND WASTEWATER COLLECTION SYSTEMS IN FORSYTH COUNTY, NORTH CAROLINA WITH URBAN DEVELOPMENT FORECASTS: 1968-1978-2010. City-County Planning Board, Winston-Salem, N.C.

For primary bibliographic entry see Field 05D. W73-14233

AMARILLO, TEXAS: REPORT ON WATER DISTRIBUTION SYSTEM, 1967.
Freese, Nichols and Endress, Fort Worth, Tex.

January, 1968. 36 p, 6 fig, 4 plates, 13 tab, 3 ap-

Descriptors: \*Water distribution, \*Distribution systems, Water requirements, Design criteria, Planning, Water supply, \*Texas. Identifiers: Capital improvements, Amarillo (Tex), Condice Pine (Tex) Canadian River (Tex).

Specific water distribution requirements can be predicted with confidence for about five year periods. Thus, this engineering-oriented study is an extension or re-evaluation of a study conducted in 1962. The study includes an analysis of water demands and peak water use rates, a description of the existing distribution system, a presentation of the existing distribution system, a presentation of engineering design criteria, an analysis of the capability of the existing system to meet future requirements, and a table of specific improvements for the five year period up to 1972. The report focuses on a detailed improvement program but it also serves as a general guide for water distribution planning to the year 1990. Among the long-range guidance issues discussed are the use of the Canadian River for a new source of water. of the Canadian River for a new source of water. the eventual use of groundwater, and the need for one or two new pressure zones as the metropolitan area expands. (Elfers-North Carolina) W73-14243

WATER USE, CONSUMPTION, AND OUT-LOOK IN THE U.S. IN 1970, Geological Survey, Washington, D.C. Water

rces Div.

C. R. Murray. Journal of the American Water Works Associa-tion, Vol 65, No 5, p 302-308, May 1973. 7 fig, 5

Descriptors: \*Water utilization, \*Water users, Descriptors: "water utilization, "water users, "Water consumption (Except consumptive use), 'United States, Annual, Water supply, Water de-mand, Domestic water, Industrial water, Mu-nicipal water, Stock water, Irrigation, Surface waters, Groundwater, Water reuse, Water resources, Projections. Every 5 years the U.S. Geological Survey does a study of water use in the United States. In this summary of the report for 1970, comparisons and estimates are made, and every major type of water use is investigated. Estimates of water withdrawals and water consumption in the US in 1970 inclide about 370,000 mgd or 1,800 gal per capita per day for uses other than the generation of hydroelectric power. About 87,000 mgd of the fresh water withdrawn was consumed; this amounted to about 420 gal per capita per day. About 2,800,000 mgd was withdrawn for hydroelectric power generation; this, like other withdrawal figures, is a cumulative figure because it includes water withdrawn from and returned to streams several times along their courses. Water used for hydroelectric-power generation is equivalent to 2-1/3 times the total runoff in the conterminous US. (See also W72-13829) (Knapp-USGS) USGS)

A COMPARISON OF URBAN WATER USE IN AUSTRALIA AND THE U.S., Swinburne Coll. of Tech., Hawthorn (Australia). C. R. Weeks, and T. A. McMahon. Journal of the American Water Works Associa-tion, Vol 65, No 4, p 232-237, April 1973. 2 fig, 3 tab, 6 photo, 26 ref.

Descriptors: \*Water utilization, \*Water demand, Australia, Industrial water, Water measurement, \*\*United States, Statistical methods, Correlation analysis, Cities, Urbanization.

Identifiers: Melbourne (Australia), Victoria (Australia)

A quantitative study to evaluate factors involved in residential and industrial water use in Australia was conducted. Levels and patterns of water use in Australia and the United States were compared. Data on Australian water use came from the major metropolitan areas, although specific residential water-use data came from three study areas in Victoria. All data on water use in the United States came from published reports. Some conclusions rom the comparison were: present per capita water use in Australian cities is approximately 80% of the use in U.S. cities; overall per capita growth rate in water use is higher in Australian cities than in the U.S.; industrial water use in Melwaren are unit of secondarios; consenting the content of the co bourne per unit of production is generally lower than the corresponding U.S. figures; components of household use are similar in the two countries; household use of water in the Australian studyarea is greater in unmetered and free water-supply areas than in metered areas (whereas in U.S. cities areas than in metered areas (whereas in U.S. cities there appears to be no significant difference); and peak rates of demand in Victoria appear to be greater than in U.S. cities. Total demand by the 2000 for Australian cities is estimated to be year 2000 for Australian cities is estimated to be 150-190 USgped, which compares with the Water Resources Council figure of 170 USgped for the U.S. (Stein-North Carolina) W73-14483

WATER RESOURCES OF MIDDLE GEORGIA Briley, Wild and Associates, Daytona Beach, Fla.

Available from the National Technical Informa-tion Service. Prepared for Middle Georgia Area Planning Commission, Macon. March 1972. 260 p, 33 tab, 23 plates, 4 append. MGAPC-71-08. CPA-GA-04-00-0164.

Descriptors: \*Planning, \*Water quality control, \*Flood control, \*Non-structural alternatives, \*Water supply, Storm runoff, Water resources,
\*Management, \*Georgia.
Identifiers: Middle Georgia Area, Dual drainage

system, Flood plain management.

A comprehensive and qualitative study of water supply, water quality control, storm drainage, flood control, and flood plain management for a seven county area around Macon, Georgia is

presented. It is intended to define general relation-ships and offer broad alternatives rather than design specific projects. The report has four basic design spectus projects. In report has four basic sections: (1) an inventory and analysis of the region's water resources including supply and demand estimates to 1990 when publicly owned water supplies are expected to be called upon to deliver about 50 mgd of water to domestic, industrial, and commercial users: (2) an outline of a trial, and commercial users; (2) an outline of a water resources management program including principles for the allocation of surface water and groundwater resources and some policies on runoff related to water quality control; (3) a long range storm drainage and flood control plan that uses a dual drainage system concept whereby a man-made system handles small storms, and natural drainage ways are used for large storms; ar a flood plain management program including flood plain zoning, flood hazard identification, flood warning, subdivision regulations, and building codes. Non-structural rather than structural measures are emphasized. (Elfers-North Carolina) W73-14499

FUTURE ALLOCATIONS OF LAND AND WATER: IMPLICATIONS FOR AGRICULTURAL AND WATER POLICIES,

Iowa State Univ., Ames. Center for Agricultural and Rural Development. H. C. Madsen, E. O. Heady, K. J. Nicol, and S. H.

Hargrove. Journal of Soil and Water Conservation, Vol 28, No 2, p 52-60, 1973. 9 fig, 7 tab., 20 ref.

Descriptors: \*Agriculture, \*Institutional constraints, \*Water demand, \*Water allocation (Policy), \*Pricing, Linear programming, Forecasting, Economic efficiency, Land development, Resources development, Water utilization, Competing uses, Crops, Livestock, Food abudance, Economics, Water requirements, Irrigation,

Identifiers: \*Optimal food production, Policy recommendations.

A review of agricultural, land use, and water resources development policy clearly indicates a history of conflicting policy goals. If future food and fiber needs are to be met, the correct mix of policies for development and compensation must be established. A linear programming model was used to establish the possible outcomes during the year 2000, given a framework of selected sets of alternative assumptions concerning farm policy, population, water prices, exports, and technological change. The cost of meeting domestic and ex-port demands for food and fiber was minimized subject to land and water resources. Three general results followed from the analysis: (1) Land should not become physically or economically scarce in 2000; (2) given a national objective of economically optimal food production and land and water use, Western drylands should increase; and (3) given this same economic objective, water would be in surplus supply in the West. Thus, water development for agriculture should be minimized and irrigation development halted if public cost for maintaining given national levels of farm prices and income is to be minimized. (Weaver-Wiscon-W73-14521

WATER QUALITY AND CONSUMER COSTS. Orange County Water District, Santa Ana, Calif. For primary bibliographic entry see Field 06C. W73-14536

WATER SUPPLY PLAN (REVISED) FOR COLUMBUS-FRANKLIN COUNTY, Mid-Ohio Regional Planning Commission, Colum-

W. B. Habig, H. T. Merwin, R. B. Cooper, and K.

A. Cristofani. December, 1972. 33 p, 5 fig, 4 tab, 5 plates, 1 append. HUD-Ohio-P-307.

#### Field 06-WATER RESOURCES PLANNING

#### Group 6D-Water Demand

Descriptors: \*Planning, \*Water supply, \*Water demand, \*Water distribution, Environmental effects, Water sources, Groundwater, Reservoirs,

Identifiers: Columbus (Ohio), Franklin County (Ohio).

Revisions of the water supply plan element of the Adopted 1969 Water-Related Facilities Plan were necessary because of rapid urban growth and changing water demands, new state and federal legislation, and the increasing concern for environ-mental quality. The report focuses on new water demand projections up to year 2000, an analysis of possible sources of water supply including ground-water, on-stream reservoirs, and upground storage reservoirs, and update water distribution system plans. Recommendations for the future include the use of groundwater for the next increment of water supply, the study of environmental impacts of possible upground reservoirs, the consideration of wastewater recycling possibilities, the determination of the impact of potential large industrial water users, the implementation of an erosion conreason users, the implementation of an erosion control program to protect siltation of water supply reservoirs, and the formulation of a new longrange distribution system scheme. The basic theme is one of increasing the flexibility for future action. (Elfers-North Carolina) W73-14679

#### 6E. Water Law and Institutions

PRIVATE SECTOR REACTION TO NORMAL POLITICAL INSTITUTIONAL PROCEDURES AND OUTCOMES WHEN WATER IS AN ISSUE, Clemson Univ., S.C. Dept. of Political Science. H. E. Albert, and D. N. Hall.

Available from the National Technical Informa-tion Service as PB-223 375, \$6.50 in paper copy, \$1.45 in microfiche. Water Resources Research Institute, Clemson University, Clemson, S. C. Report No. 37, 1973. 279 p, 9 fig, 12 tab, 5 append. OWRR B-034-SC (6).

Descriptors: \*South Carolina, Social aspects, Political aspects, Administration, "Water pollu-tion, Economics, "Environmental effects, Coasts, "Institutions, "Federal government, "State

governments.
Identifiers: Beaufort County (S.C.), Hilton Head
Island (S. C.), Columbia (S.C.).

Files, public records and interviews were used to reconstruct a conflict which occurred in South Carolina in 1969 and 1970. The purpose was to establish points of contact between government and various parts of the private sector, determine intergovernmental and interagency relationships, discover the methods used by interest groups to obtain governmental support, and pinpoint possible breakdowns of communication between governmental agencies and between government and the private sector. The conflict centered in the coastal area of South Carolina and dealt with the plans of the Badische Anilin und Soda Fabrik (BASF) Corporation to locate a chemical plant at Victoria Bluff. The residents of nearby Hilton Head Island opposed the plant on the basis of probable pollution. Included in the Hilton Head population are numerous retired business and military leaders, who had both the time and skills necessary to mount a major interest group op-postion movement. The opposition was both skill-ful and effective. BASF finally withdrew all plans for locating their plant in Beaufort County. State officials supported the industry and were un-prepared for massive and effective opposition to their normal procedures. Much of their reactions, therefore, was uncoordinated and divisive in its ef-fect. The opposition found its major support with the national government and this interjected elements of federalism.

**PROCEEDINGS** SIXTEENTH ANNUAL WATER CONFERENCE. New Mexico State Univ., University Park. Water Resources Research Inst. For primary bibliographic entry see Field 04A. W73-14224

THE PLACE OF LOCAL AUTHORITIES IN THE MANAGEMENT AND DEVELOPMENT OF WATER RESOURCES,

Manchester County Borough (England). G. C. Ogden. Effluent and Water Treatment Journal, Vol 11, No 11, p 607-611, November, 1971.

Descriptors: \*Institutions, \*Administrative agencies, \*Governments, Water resources develop-ment, Management, Planning, Coordination. Identifiers: \*Water authorities (England).

Governmental organization for water resource planning and management in England is discussed. The Central Advisory Water Committee appointed to deal with this question recognized the need for national and regional coordination of water resource functions but could find no objective basis on which to recommend between central government-oriented regional water authorities and local government-oriented single purpose authorities. Although local authorities have been recently criticized, they have accomplished sig recently criticized, they have accomplished sig-nificant water resource programs and levels of ser-vice and are better than regional authorities in that they are more responsive to the social needs of the people, they have closer links to other planning authorities such as for housing, recreation, and health, and they would be more effective in terms of local coordination and implementation, particu-larly in resolving conflicts publically. In addition, the local authorities could have representatives on regional authorities for coordination at a broader scale and policy formulation. (Elfers-North Carolin W73-14230

**GULL LAKE-WATER LEVEL STABILIZATION.** Red Deer Regional Planning Commission (Alberta).

October, 1968, 9 p. append.

Descriptors: Management, \*Water sports, \*Phreatophytes, \*Water level fluctuations, Agriculture, Stabilization, Outdoor recreation, Land classification, 'Canada. \*Water sports, Identifiers: \*Gull Lake (Alberta).

This brief, requesting assistance under Part VIII Agriculture and Rural Development Act, proposes a project to stabilize water levels in Gull Lake by watershed management in the Gull Lake and Upper Lloyd Creek Basin involving improved land use and productivity by means of drainage, phreatophyte control and diversion. Decline in the Gull Lake water level and extension of marshy beach areas are noted, having detrimental effects on current and future recreational use of Gull Lake. Potential project benefits are ennumerated, including those both for agriculture and recreation, with the conclusion that the optimum value should be obtained from all resources within the area considered for action in this scheme. Proposed future investigation is outlined, accom-Proposed future investigation is outlined, accom-panied by a cost sharing scheme for the project. Appended are maps of soil capability, oil and gas well locations, recreational capability, shoreland capability, and brief summaries of two preceding studies. (Edwards-North Carolina)

INTERNATIONAL CONFERENCE REMOTE SENSING IN ARID LANDS, CONFERENCE Arizona Regional Ecological Test Site, Tucson. For primary bibliographic entry see Field 07C. RESEARCH FOR APPLICATION OF REMOTE SENSING TO STATE AND LOCAL GOVERN-MENTS (ARSIG), Arizona Univ., Tucson. Office of Arid Lands Stu-

For primary bibliographic entry see Field 07C.

CANADA ANIMAL WASTE MANAGEMENT

Department of Agriculture, Ottawa (Ontario). Animal Waste Management Guide Committee. For primary bibliographic entry see Field 05G. W73-14392

CONCEPTUAL MODEL OF A REGIONAL WATER QUALITY AUTHORITY, Harvard Univ., Cambridge, Mass. For primary bibliographic entry see Field 05G. W73-14459

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AN ILLUSTRATIVE MODEL OF RIVER BASIN POLLUTION CONTROL, Harvard Univ., Cambridge, Mass. For primary bibliographic entry see Field 05G.

FLOW REGULATION FOR WATER QUALITY MANAGEMENT, Cornell Univ., Ithaca, N.Y. Dept. of Environmental Engineering. For primary bibliographic entry see Field 05G. W73-14466

FLOOD INSURANCE: REPORT FLOOD INSURANCE: A REPORT ON ASSISTANCE TO FLOOD VICTIMS IN UNIN-CORPORATED LAKE COUNTY, ILLINOIS. North Branch Chicago River Flood Control Steering Committee, Ill.
For primary bibliographic entry see Field 06F.

IMPLICATIONS OF PLLRC TAX RECOMMEN-DATIONS FOR FEDERAL HYDRO PROJECTS AND POWER FACILITIES,

Tennessee Valley Authority, Knoxville. Div. of Navigation Development and Regional Studies. C. M. Stephenson. Land Economics, Vol 49, No 1, p 67-75, 1973. 5

tab. 13 ref.

Descriptors: \*Public lands, \*Taxes, \*Compensa-tion, \*Federal government, Multi-purpose pro-jects, Powerplants, Income, Local governments, State governments, Federal project policy, Ten-nessee Valley Authority. Identifiers: \*In-lieu-tax payments, Revenue shar-

Public Land Law Review Commission (PLLRC) has developed recommendations with respect to the problem of revenue sharing and pay-ments in lieu of taxes on federal property. These are evaluated in connection with six hydro and power projects in which payments to states and counties are currently made. The TVA payment accounted for 82% of all shared revenues and payments in lieu of taxes for all federal hydro and power projects in fiscal 1970. The remainder of the total \$19.6 million was accounted for by the Army Corps of Engineers, Bureau of Reclamation, and the Federal Power Commission. The TVA pay-ment increases steadily because it is based on growing power revenues. However, the Bureau of Reclamation and the Corps of Engineers multipurpose hydro projects base such payments neither on federal investment nor on power sales' revenues. Federal payments in lieu of taxes as compared to estimated value of Federal property or revenue of multipurpose projects were found to be meager with the exception of the TVA. Given the PLLRC recommendations for a uniform policy

where payments would reflect a public benefits discount of 10-40% of revenue based on private ownership, the major problem is estimating the amount of potential payments to state and local governments. (Weaver-Wisconsin) W73-14512

# ONTARIO'S WATER TAKING PERMIT PRO-

GRAM, Ontario Ministry of the Environment, Toronto. Water Quantity Management Branch. R. P. Dennis.

Water Resources Bulletin, Vol 9, No 1, p 41-48, 1973. 5 fig. 6 ref.

Descriptors: \*Water allocation (Policy), \*Water Descriptors: "Water allocation (Policy), "Water permits, "Equitable apportionment, Water supply, Legislation, Common law, Surface water, Groundwater, Water utilization, Wells, Preferences (Water rights), "Canada. Identifiers: "Ontaria.

Permits issued by the Ontario Ministry of the Environment are required for most water takings in Ontario which are in excess of 10,000 gallons per day for purposes other than domestic, farm or fire fighting. The water-taking program provides pro-tection and control beyond that under common law for situations ranging from water-supply inter-ference between individuals to competing de-mands. Permits do not create water rights and require permittees to ensure that sufficient water is made available for the needs of prior users. The application of the permit program to an interdisciplinary water-management problem is illus-trated by the case of the installation of two high-capacity municipal wells in the rural area of Hunsburger Creek basin to provide additional water for Kitchener, Ontario. Specific permit requirements were designed to protect existing well supplies, streamflow, pond levels and fish. An additional case study of potential conflict in uses of the Big Creek basin indicated that tobacco irrigation reduced stream-flow significantly and that detailed water-management plans for years of extreme ir-rigative demand should be developed. (Weaver-Wisconsin) W73-14525

# DECISION-MAKING IN WATER RESOURCE

ALLOCATION,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 06B. W73-14609

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# REALITIES OF URBAN WATER RESOURCES

OPERATING PERSPECTIVE,
Washington Suburban Sanitary Commission,
Hyattsville, Md. For primary bibliographic entry see Field 03D. W73-14614

# WATER SUPPLY PROJECTS IN DEVELOPING

COUNTRIES,
Parsons (Ralph M.) Co., Los Angeles, Calif.
For primary bibliographic entry see Field 04A.

# **ENVIRONMENTAL IMPACT REQUIREMENTS** IN THE STATES, Center for California Public Affairs, Claremont.

For primary bibliographic entry see Field 05G. W73-14749

#### 6F. Nonstructural Alternatives

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: 1973 CONTRIBUTIONS, California Univ., Los Angeles. Dept. of Engineering Systems

For primary bibliographic entry see Field 06A. W73-14204

# FLOOD PLAIN INFORMATION, CLARK-SVILLE, TENNESSEE. Army Engineer District, Nashville, Tenn. For primary bibliographic entry see Field 04A W73-14238

STATUS OF FLOOD-PLAIN MAPPING, GREATER PITTSBURGH REGION, PENNSYL-Geological Survey, Carnegie, Pa. For primary bibliographic entry see Field 07C. W73-14352

# FLOOD INSURANCE: A REPORT ON ASSISTANCE TO FLOOD VICTIMS IN UNIN-CORPORATED LAKE COUNTY, ILLINOIS. North Branch Chicago River Flood Control Steering Committee, Ill.

Prepared for Lake County Board. November 1972.

Descriptors: \*Flood plain insurance, Flood plain zoning, Flood plains, Coordination, Flood damage, Flood protection, \*Illinois, Land use. Identifiers: \*Land use controls, \*Flood plain management, \*Federal Flood Insurance Program, \*Lake County (III).

The North Branch Chicago River Flood Control Steering Committee was created in 1972 to study flood problems in Lake County and help propose flood relief measures. Their findings are presented on the federal Flood Insurance Program in relation to Lake County. The Flood Insurance Program enables property owners in flood prone areas to purchase flood insurance with the premiums sub-sidized up to 90% by the federal government. However, this program is only available if the local government in question qualifies via meeting certain federal requirements such as (1) preparing information and maps covering existing flood programs, (2) enacting minimum land use controls (e.g. building codes, zoning ordinances) in flood prone areas, (3) assuring that future flood plain management will be carried out, and (4) designatmanagement win be carried out, and cy designating a local coordinator to be responsible for carrying out the federal Program. Lake County can meet the federal requirements. The creation of a Comprehensive Flood Programs Coordinating Committee is recommended. (Elfers-North Carolina) W73-14485

FLOOD HAZARD STUDY. Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga.

December 1971. 38 p, 6 fig, 1 tab, 1 append.

Descriptors: \*Flood plain zoning, \*Flood plain insurance, \*Flood control, Planning, Non-structural alternatives, Drainage, \*Georgia, Land use, \*Regulation.
Identifiers: \*Savannah (Chatham County).

The Chatham County-Savannah area is characrivers and waterways. Much of the area is vulnera-ble to flooding by extensive rainfall, tidal flooding, or a combination of both. Flooding incidents in 1964 and 1970 highlighted the fact that development has been allowed to take place in areas where physical protection from flooding is poor or entirely lacking. The objective of this study is to present regulations of land use within the flood damage prone zones that will aid in minimizing flood damage, while at the same time insuring the continuous of the continuous control of the continuous control of the control tinuance of Federal Flood Insurance for Chatham County. Consequently, the recommendations presented adhere closely to federal guidelines. Pri-

mary preventive measure suggested is a Flood Plain District Ordinance, the content of which is explicitly stated. Other preventive measures, such as subdivision regulations, building codes, and other health regulations, are similarly stated in totum; while warning signs, development policies, open spaces and tax adjustments are only generally recommended as needing implementation. As part of a two-pronged approach to flood damage control, needed corrective measures as well as preventive measures are cited. Primarily, channel improvements, watershed treatment, water reservoirs, levees and walls are recommended. (Hoffman-North Carolina) W73-14491

# DES PLAINES RIVER VALLEY: GOALS, POLI-

CIES, AND RECOMMENDATIONS.
Des Plaines River Valley Comprehensive Plan Steering Committee, Ill.

Prepared for Lake County Board of Supervisors. (1971). 4 p.

Descriptors: \*Flood plains, \*Planning, \*Recreation, Water quality, Coordination, Small watersheds, Flood control, Urbanization, \*Il-

Identifiers: \*Flood plain management, Water resource policies, Lake County (III), Forest preserves, \*Des Plaines River (III).

In July, 1970, the Des Plaines River Valley Comprehensive Plan Steering Committee was created by the Lake County Board of Supervisors to develop an overall plan for the river valley and to help coordinate policy formulation and plan implementation. The Des Plaines River which flows 35 miles through Lake County has a history of flooding, as its channel capacity is quite limited, and has recently been deteriorating in water quality. Goals and policies are being formulated in three broad areas of concern: flooding and water management; sanitation and water resources; and recreation and public relations. Some of these policies include the multiple uses of the Des Plaines River, the implementation of flood plain regulations, the acquisition of flood plain areas, the careful planning of large scale developments to control storm runoff, the adoption of Illinois EPA water quality standards and the development of the entire waterfront areas as part of the Lake County Forest Preserve system. Specific recommendations for action focus on acquiring flood plain areas with priority given to 'sites having geological, ecological or historic value, and sites which are being threatened by urbanization', developing the river as a 'water trail' for canoeing and fishing, controlling erosion and sedimentation by use of regulating weirs and dams on river and tributaries, control of storm water runoff, contour plowing of farm lands, and ground cover plantings, and allowing only low intensity urban development in the valley. (Elfers-North Carolina)
W73-14495

# RIVERBANKS IMPROVEMENT PROGRAM, (RROOME AND TIOGA COUNTIES, N.Y.). Broome County Planning Dept., Binghamton, N.Y.; and Southern Tier East Regional Planning Board, Binghamton, N.Y. For primary bibliographic entry see Field 03D.

W73-14678

STUDY OF THE CINCINNATI RIVERFRONT -PART I: REGIONAL ASPECTS.
Cincinnati Planning Commission, Ohio.
For primary bibliographic entry see Field 06B.

# Field 06-WATER RESOURCES PLANNING

### Group 6F-Nonstructural Alternatives

THE URBAN RIVER: A STAFF PROPOSAL FOR WATERFRONT DEVELOPMENT IN THE DISTRICT OF COLUMBIA.
National Capital Planning Commission, Washing-

For primary bibliographic entry see Field 03D.

W73-14686

#### 6G. Ecologic Impact of Water Development

RESOURCES CONFERENCE,

W73-14239

SHORELINE ANALYSIS OF THE CITY OF SARASOTA. Smally, Wellford and Nalven, Sarasota, Fla For primary bibliographic entry see Field 06B.

TRANSACTIONS OF THE 37TH NORTH WILDLIFE NATURAL **AMERICAN** 

Meeting held in Mexico City, Mexico, March 12-15, 1972. Wildlife Management Institute: Washing-ton, D.C., 1972. J. B. Trefethen, editor. 472 p. Il-lus, Maps. Paper. Pr. 56.50. Identifiers: Birds, Books, \*Conferences, Fishes, Human population, \*Natural resources, Sea, Sym-posium, Transactions, Turtle, \*Wildlife.

This book contains contributed papers presented at the conference on various aspects of wildlife conservation and management. Part 1 contains papers international conservation challenges, includes papers on renewable natural resources in Mexico; human population, food demands and wildlife needs; balancing human populations with life support systems; and need for a new North American wildlife policy. Part 2 contains technical sessions on natural resources, coastal and marine resources; new needs and views in resource planning; and water, fish, wildlife and society. Part 3 is composed of the reports of special panels involving the ceremony marking the amendment of the 1936 convention for the protection of migratory birds, and the implementation of the council of environmental quality. Finally, the closing general session includes papers on subjects involving soil erosion, chemical contamination of soil and water and recycling of solid wastes.--Copy-right, Biological Abstracts, Inc. W73-14526

#### 07. RESOURCES DATA

#### 7A. Network Design

MEASUREMENT OF FLOOD FLOW AND SEDIMENTATION SUSPENDED SEDIME RADIOISOTOPE METHOD. Taiwan Power Co., Taipei. For primary bibliographic entry see Field 07B. W73-14540

DECISIONS WITH INADEQUATE HYDROLOG-IC DATA.

For primary bibliographic entry see Field 02A. W73-14550

IMPROVEMENT OF HYDROLOGICAL SER-VICES IN BOLIVIA,

World Meteorological Organization, La Paz

L. E. Paredes-Arce, and W. Klohn.
In: Decisions with Inadequate Hydrologic Data; Proceedings of 2nd International Symposium in Hydrology, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 40-47, 1973. 1 fig, 8 ref. Descriptors: \*Data collections, \*Network design, Peconomics, "Cost-benefit analysis, Project planning, Decision making, Gages, Instrumenta-tion, Hydrologic data, Water measurement, Stream gages, Rain gages, Precipitation gages, Identifiers: "Inadequate hydrologic data, "Bolivia.

The Bolivian Government created a unified hydrological and meteorological service in 1968. Available national and international resources are not sufficient for implementation and operation of a minimum national hydrologic network according a minimum hauona nyarologic network according to the WMO network density criteria. Therefore, a pragmatic approach is required, following dif-ferent policies in agreement with regional geo-graphic reality. In the mountainous area, priority will be given to immediate and obvious project needs; these will not be satisfied by single stations in project sites, but by local networks. In the eastern plains of Bolivia, no real network is possible owing to geographic isolation, but reference stations will be installed as far as allowed by accessibility of sites and available facilities. Once installed, continued operation of stations will be emphasized. (See also W73-14550) (Knapp-USGS) W73-14554 needs; these will not be satisfied by single stations

THE USE OF TRACER DATA IN INCREASING THE INFORMATION ON HYDROLOGIC SYSTEMS, Weizmann Inst. of Science, Rehovot (Israel). Isotope Dept For primary bibliographic entry see Field 02A. W73-14558

EXPERIENCE WITH A MONTHLY RAINFALL--RUNOFF TRANSFER FUNCTION MODEL, Lahmeyer International G.m.b.H., Frankfurt am Main (West Germany). For primary bibliographic entry see Field 02A. W73-14560

THE USE OF EVOP AS A HYDROLOGIC TOOL, British Columbia Univ., Vancouver. Dept. of Civil Engineering For primary bibliographic entry see Field 02A. W73-14561

A SIMULATION TECHNIQUE OF MONTHLY RUNOFF BY USE OF PRECIPITATION TIME SERIES AT MULTISTATIONS. Hokkaido Univ., Sapporo (Japan). Dept of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14562

#### 7B. Data Acquisition

ASSESSMENT OF AUTOMATIC SEWER FLOW SAMPLERS, Hydrospace-Challenger, Inc., Rockville, Md. For primary bibliographic entry see Field 05A. W73-14221

VERSATILE COMBUSTION-AMALGAMATION TECHNIQUE FOR THE PHOTOMETRIC DETERMINATION OF MERCURY IN FISH AND ENVIRONMENTAL SAMPLES, AND ENVIRONMENTAL SAMPLES,
National Marine Fisheries Service, Ann Arbor,
Mich. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 05A.
W73-14271

THERMAL REMOTE SENSING ON THE MIS-SISSIPPI RIVER IN IOWA, Geological Survey, Iowa City, Iowa. For primary bibliographic entry see Field 05A. W73-14286

PREPARATION AND PROPERTIES OF THE SULFATE ION SELECTIVE MEMBRANE ELECTRODE,
State Univ. of New York, Buffalo. Dept. of Chemistry. For primary bibliographic entry see Field 02K. W73-14301

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ESTIMATING PRECISION FOR THE METHOD OF STANDARD ADDITIONS, Oregon State Univ., Corvallis. For primary bibliographic entry see Field 02K. W73-14305

SOME INSTRUMENTS AVAILABLE NOW FOR THE MEASUREMENT OF WASTEWATER PARAMETERS, Ionics, Inc., Watertown, Mass. Instrument Div. For primary bibliographic entry see Field 05A. W73-14321

PRACTICAL EXPERIENCE OF THE WATER RESOURCES DIVISION IN THE USE OF MUL-TIPARAMETER ELECTRONIC RECORDERS AND AUTOMATED TECHNIQUES FOR MONI-TORING WATER QUALITY IN STREAMS, Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 05A.
W73-14323

PROCEEDINGS OF THE THIRD ANNUAL CONFERENCE ON REMOTE SENSING IN ARID LANDS. Arizona Univ., Tucson. Office of Arid Lands Stu-

Arizona University, Tucson, Office of Arid Lands Studies. November 1972. 379 p, 183 fig, 5 tab, 163

Descriptors: \*Remote sensing, \*Arid lands, \*Land use, \*Irrigation practices, \*Terrain analysis, Surveys, Photogrammetry, Soil moisture, Soil-water-plant relationships, Natural resources, River basins, Flood forecasting, Wheat, Australia, California, Arizona, Data collections.

Of the 24 papers presented a number are addressed to the use of remote sensing in water-oriented problems: The NOAA/NESS program of remote sensing of soil moisture relates to the development of a satellite sensor to provide soilmoisture evaluation in large river basins in order to improve flood and water-level forecasts. Application of a directional reflectance model to w canopies under stress enables one to establish the expected consistency between the biological conditions and the remotely-sensed effect. The use of remote sensing techniques in the arid lands of Austrails has been applied to land use potential, range-land studies, and mineral exploration and geology, a prime example of the number of operational apcations to studies and inventories of an arid environment. Vegetation-terrain feature relation-ships in southeast Arizona may be determined on relatively small-scale imagery as a valuable indica-tor of vegetation distribution in an arid area. Monitoring the effects of a changing resource base in an arid lands area: The west side of the San Joaquin Valley, California, illustrates the use of remote sensing to determine land use changes in this arid region for the years 1957 and 1971, focusing on the nature, location, magnitude, direction, and rate of such changes. Remote sensing of irrigation techniques and crop patterns in the Douglas basin, Arizona, describes 7 test areas, irrigation methods wised in each, and the crop type, showing conclusively that remote sensing is an effective method of determining the relationship of tail water runoff to various irrigation practices. (See W73-14327 thru W73-14350) (Paylore-Arizona) W73-14326

#### Data Acquisition—Group 7B

INTERNATIONAL. CONFERENCE ON REMOTE SENSING IN ARID LANDS, Arizona Regional Ecological Test Site, Tucson. For primary bibliographic entry see Field 07C. 73-14327

ORBITAL AND AERIAL (RB-57) PHOTOGRAPHY FOR MAPPING SOILS AND GEOLOGY IN SEMI-ARID WEST TEXAS AND EASTERN IN SEMI-AMID ... NEW MEXICO, Tech Univ., Lubbock. Dept. of

For primary bibliographic entry see Field 07C. W73-14328

EVALUATION OF ERTS-1 IMAGERY FOR AN INVENTORY OF POST-1890 ACCELERATED EROSION.

Geological Survey, Tucson, Ariz. For primary bibliographic entry see Field 07C. W73-14329

THE NOAA/NESS PROGRAM OF REMOTE SENSING OF SOIL MOISTURE, National Environmental Satellite Service, Washington, D.C.

D. R. Wiesnet.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Land Studies, p 66-72, 1972. 3 fig, 6 ref.

Descriptors: \*Remote sensing, \*Microwaves, \*Soil moisture, Aircraft, Satellites (Artificial), Arid lands, Deserts, Arizona, Radiation, Data col-Identifiers: \*Microwave radiometry.

Radiation emitted in the microwave band of the electromagnetric spectrum by a wet soil is quite different from that emitted by a dry soil. Considerably less energy is detected from the wet sucrably less energy is detected from the wet soils, and emissivity also varies with the wavelength. A 13.4 GHz radiometer detects radia-tion emitted from a depth of 5 cm in dry soil. By using lower frequencies, it is possible to sense radiation that is deeper in the soil. (See also W73-14326) (Knapp-USGS) W73-14330

METALLOGENIC SIGNIFICANCE OF ALASKAN GEOSTRUCTURES SEEN ON NIMBUS AND ERTS IMAGES,

For primary bibliographic entry see Field 07C.

BASIC CONSIDERATIONS OF HIGH RESOLU-TION SIDE-LOOKING RADAR IMAGERY, Goodyear Aerospace Corp., Litchfield Park, Ariz. Sensor Applications Engineering. E. S. Leonardo.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 78-103, 1972. 19 fig.

Descriptors: \*Remote sensing, \*Radar, \*Aircraft, \*Topographic mapping, Terrain analysis, Data collections, Forests, Geology, Land use. Identifiers: \*Side-looking radar.

High resolution side-looking radar is an active sensor capable of day or night operation and, depending on wavelength, unaffected by weather conditions. The end product is an image that can be interpreted and analyzed by geologists, foresters, cardoneanhers and other corther institute. cartographers and other earth scientists. High resolution side-looking radars direct a narrow beam of energy at right angles to the flightpath. A pulse of radar energy is transmitted from the radar antenna, and the relative intensity of the reflec-tions is used to produce an image of a narrow strip of terrain. The wavelength of energy used in high resolution radars varies from about 1 cm to 3 cm. (See also W73-14326) (Knapp-USGS) W73-14332

THE APPLICATION OF RADAR AND INFRARED IMAGERY TO QUANTITATIVE GEOMORPHOLOGICAL PROBLEMS, Texas Univ., Austin. Bureau of Economic Geological Programme Control Control

P. J. Cannon.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 104-123, 1972. 12 fig, 5 ref.

Descriptors: \*Remote sensing, \*Radar, \*Infrared radiation, \*Small watersheds, Mapping, Geologic mapping, Terrain analysis, Data collections, Vegetation, Drainage patterns (Geologic).

A detailed quantitative geomorphic investigation of an area can be supported by radar and infrared imagery. The Mill Creek drainage basin in south-central Oklahoma was selected as the area for study because of the availability of the data. The procedures of radar integration of the contraction of usefulness of radar imagery as a quantitative geomorphic tool depends on the size of the area to be investigated, the relief, and the distribution of vegetation. Infrared imagery can provide geomorphic information comparable in amount and quality to information taken from some photo-graphic and topographic studies. Radar and ingraphic and topographic studies. Radar and in-frared imagery can be used in conjunction to coun-teract their shortcomings, providing a new and valuable tool to the quantitative geomorphologic investigations of drainage basins. Regional evalua-tions of drainage basins can be made with radar imagery, and infrared imagery can provide special data about small component basins and portions of basins. (See also W73-14326) (Knapp-USGS) W73-14333

APPLICATION OF A DIRECTIONAL REFLECTANCE MODEL TO WHEAT CANO-PIES UNDER STRESS, Michigan State Univ., East Lansing. Dept. of

Botany.
G. R. Safir, G. H. Suits, and M. V. Wiese.
In: Proceedings of the Third Annual Conference
on Remote Sensing in Arid Lands; Tucson,
November 1972: Arizona University Office of Arid Lands Studies, p 124-135, 1972. 6 fig, 8 ref.

Descriptors: \*Remote sensing, \*Infrared radia-tion, \*Moisture stress, \*Wheat, Surveys, Data col-lections, Mathematical models.

A mathematical model was used to predict the directional reflectance of two wheat canopies under disease stress by wheat spindle streak mosa-ic virus and of the same two canopies under mild water stress. The model enables the directional reflectance of a given crop canopy to be traced to causative factors which are both geometrical and spectral in nature. Field measurements were made of the spectral reflectance of healthy wheat at two angles of view and at two stages of growth. The measured reflectances, in the spectral range of 0.5 to 1.3 micrometers, agreed well with values predicted by the model, indicating that the major components of a wheat canopy that contribute to its directional reflectance can be identified and analyzed. Using the model, it is possible to provide insights as to which detection techniques are most likely to be successful for the detection of wheat and wheat stresses. (See also W73-14326) (Knapp-W73-14334

THE USE OF REMOTE SENSING TECHNIQUES IN THE ARID LANDS OF AUS-TRALIA, California

Remote Sensing Unit., Santa Barbara. Geography Remote Sensing Unit. R. R. Thaman, and D. A. Cottrell.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 136-151, 1972. 85 ref.

Descriptors: \*Remote sensing, \*Australia, \*Aerial photography, Surveys, Land use, Arid lands, Data collections, Hydrology, Vegetation, Exploration, Geologic mapping, Grazing, Ecology.

A study of the use of remote sensing techniques in arid Australia is of considerable interest for a number of reasons: (1) the extensive and isolated nature of the area makes it particularly suitable for surveys using remote techniques; (2) historically, some of the first operational surveys using remote sensing techniques on a regional basis were carried out in this area; (3) considerable research has been out in tins area; (3) considerable research has been conducted by a number of Commonwealth, State and Territorial agencies, private companies, and educational institutions in the use of remote sensing techniques; and (4) the benefits of the use of remote sensing techniques in the arid environment are of considerable economic value to Australia. tralia. (See also W73-14326) (Knapp-USGS) W73-14335

VEGETATION-TERRAIN FEATURE RELA-TIONSHIPS IN SOUTHEAST ARIZONA, Oregon State Univ., Corvallis. Re Resources Program. D. A. Movat.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 152-166, 1972. 8 fig.

Descriptors: "Remote sensing, "Satellites (Artificial), "Terrain analysis, "Vegetation, "Arizona, Geomorphology, Topography, Data collections. Identifiers: "ERTS.

ERTS-1 imagery is the first stage of a multistage sampling technique, the purpose of which is to determine the types and amounts of vegetation of sourthern Arizona. A comparison is being made of the facility with which landform identifications can be made using low sun angle monoscopic vercan be made using low sun angle monoscopic versus high sun angle stereoscopic techniques. There are positive relationships between certain plant species and certain terrain features. Not all species exhibit positive relationships with all terrain feature variables, but such studies have a definite place in plant scale legislations trigotion. The place in plant ecological investigations. The vegetation groups examined appeared to be successfully discriminated by the terrain feature variables. Terrain features mirror factors which directly influence vegetational response and hence distribution. As a result, those environmental features which can be readily and rapidly ascertained on relatively small-scale imagery may prove to be valuable indicators of vegetation distribution. (See also W73-14326) (Knapp-USGS) W73-14336

COMPARATIVE EVALUATION OF THERMAL PROFILE DATA OF HEALTHY AND INFESTED ENGLEMANN SPRUCE, Forest Service (USDA), Phoenix, Ariz. Bureau of

est Control.

D. D. Lucht, C. H. Denny, E. L. Morrison, Jr., and C. D. Worthman.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 168-187, 1972. 9 fig, 4 ref.

Descriptors: \*Remote sensing, \*Infrared radiation, \*Forestry, Insects, Plant pathology, Plant diseases, Forests, Data collections.
Identifiers: \*Engelmann Spruce trees, \*Spruce

An infrared scanner was used to collect thermal ground-truth data in coniferous forest areas. This study contributes to the knowledge necessary to

### Field 07-RESOURCES DATA

#### Group 78-Data Acquisition

utilize high altitude thermal scanner data for the previsual detection of spruce beetle investigation in the Engelmann Spruce Forest. The temperature profile of infested trees is closer to ambient air temperature than the temperature profile of healthy trees. Infested trees tend to be warmer than healthy trees during hot weather, and colder during extremely cold weather. (See also W73-14326) (Knapp-USGS)

MULTISPECTRAL REMOTE SENSED IMAGE ANALYSIS BY A SPECIAL ELECTRONIC SYSTEM, Stanford Research Inst., Menlo Park, Calif.

J. A. Eikelman, Jr.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Land Studies, p 188-205, 1972. 8 fig, 1 tab.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Data processing, Clouds, Meteorology, Digital computers, Photography, Data collections. Identifiers: \*Time-lapse photography.

A very important technique that has been applied in studying dynamics and development of clouds is the generation of time-lapse sequences of cloud photographs. This has been particularly true with the data from the applied Technology Satellites tate data from the applied rethinology Satellites
that, under normal operations, take a picture every
23 minutes during daylight hours. An electronic
system was designed for processing and analyzing
satellite and other forms of remotely sensed imagery. The system provides a number of processing-analysis features, including a time-lapse sequence production capability. The system also provides many procedures that are not so easily obtainable by photographic or other techniques. These include variable magnification, many planning selective image receil frame to. image planning, selective image recall, frame-to-frame comparison or change detection, data intermixing, spectral (brightness) analysis, areal and distance measurements, and time-lapse sequencing. These features make this electronic system uniquely attractive for real-time operational a cations. (See also W73-14326) (Knapp-USGS) W73-14338

PRODUCTION OF THEMATIC MAPS BY OPTI-CAL ANALOG PROCESSING OF COLOR TRANSPARENCIES,

Arizona Univ., Tuscon. Optical Sciences Center. F. V. Richard, and W. Swindell.

In: Processing of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 206-215, 1972. 10 fig.

Descriptors: \*Remote sensing, \*Mapping, \*Aerial photography, \*Data processing, Data collections, Analog computers.
Identifiers: \*Thematic maps.

The analog scanning technique for the production of thematic maps from color transparencies is a relatively simple technique which offers the advantages of rapid processing, good spectral sensitivity and, at the same time, relatively low cost. The processed version of the transparency is recorded line by line as the original is being scanned. This real time feature of the analog approach allows for rapid processing. (See also W73-14339) W73-14339

A COMPUTER PROGRAM FOR GENERATING SCATTERGRAMS ON THE CALCOMP

Arizona Univ., Tucson. Dept. of Geography and Area Development. For primary bibliographic entry see Field 07C.

REMOTE ANALYSIS OF AIRBORNE PARTI-CLES BY POLARIMETRY, Arizona Univ., Tucson. Lunar and Planetary Lab. D. L. Coffeen.

D.L. Cotteen.
In: Proceedings of the Third Annual Conference
on Remote Sensing in Arid Lands; Tucson,
November 1972: Arizona University Office of
Arid Lands Studies, p. 232-243, 1972. 13 fig, 8 ref.

Descriptors: \*Remote sensing, \*Optical proper-ties, \*Air pollution, Pollutant identification, Light quality, Aerosols, Particle size, Particle shape, Data collections. Identifiers: \*Polarimetry, Polarization (Light).

Particles suspended in the atmosphere can be stu-died by passive measurement of scattered sunlight in the useful wavelength range 0.3-3.5 microme-ters. For a given wavelength, time, and direction, four independent parameters are necessary and sufficient to characterize a scattered light beam: surricient to characterize a scattered igni beam; intensity, percentage linear polarization and its position angle, and percentage circular polarization. The linear polarization is especially useful in deducing intrinsic properties of particles (size, shape, refractive index) and clouds of particles (cloud being about 10 to 10 t (cloud height, cloud optical thickness). Particulate air pollution can sometimes be detected, and the particles analyzed, by polarization techniques. (See also W73-14326) (Knapp-USGS)

THE APPLICATION OF SPACE IMAGERY TO ANTHROPOLOGY,
New Mexico Archeological Center.
T. R. Lyons, M. Inglis, and R. K. Hitchcock.
In: Proceedings of the Third Annual Conference
on Remote Sensing in Arid Lands; Tucson,
November 1972: Arizona University Office of Arid Lands Studies, p 244-265, 1972. 14 fig, 10 ref.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Archeology, Land use, Cities, Urbanization, Surveys, Mapping, Data collections, Terrain analysis. Identifiers: \*Anthropology.

Remote sensing may be used in anthropology, archeology, and in ethnology. Gemine and Apolio imagery have, since the return of the first film to earth, served the earth sciences and pointed the way to more sophisticated data gathering, data handling, and data analysis systems. These systems are clearly applicable to the study of man and his environment in the analysis of patterns of human modification of the environment, of change in land use and settlement, and of the influence of physiography on man's activities. These analyses combined with the situation logic inherent in the synoptic view of a study area are all benefits now available to the anthropologist. (See also W73-14326) (Knapp-USGS)

THE KIN BINEOLA IRRIGATION STUDY: AN EXPERIMENT IN THE USE OF AERIAL REMOTE SENSING TECHNIQUES IN REMOTE SENSING TECHNIQUES
ARCHAEOLOGY,
New Mexico Archeological Center.
T. R. Lyons, B. G. Pouls, and R. K. Hitchcock.

1. R. Lyons, B. G. Pouls, and R. R. Hitchcock. In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Land Studies, p 266-283, 1972. 6 fig, 19 ref.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Archeology, \*Irrigation, Land use, Cities, Urbanization, Surveys, Mapping, Data collections, Terrain analysis.
Identifiers: \*Anthropology, \*Kin Bineola (N

Analysis of a prehistoric irrigation system at Kin Bineola, near Chaco Canyon, northwestern New Mexico, was undertaken with the use of conven-tional black-and-white aerial photographs and a

Kelsh plotter for microtopographic mapping. The purpose of this experiment was (1) to determine the effectiveness of photogrammetric procedures in identifying cultural features in an arid are of extremely low relief, (2) to aid in the interpretation extremely low relief, (2) to aid in the interpretation and analysis of any identifiable features, and (3) to determine the value of these techniques in helping to plan research strategy. A number of cultural features were identified and mapped, including canals, diversion dams, and habitation sites. The photogrammetric procedures employed are explained in some detail, and the application of these techniques to this archeological problem is demonstrated. (See also W73-14326) (Knapp-USGS) W73-14326)

AN INTERDISCIPLINARY EVALUATION OF ERTS POTENTIAL FOR ARID REGIONS, Nevada Univ., Reno. Renewable Resources For primary bibliographic entry see Field 07C. W73-14344

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MONITORING THE EFFECTS OF A CHANG-ING RESOURCE BASE IN AN ARID LANDS
AREA: THE WEST SIDE OF THE SAN
JOAQUIN VALLEY, CALIFORNIA,
California Univ., Santa Barbara. Geography

JOAQUIN VALLEY, CALIFORNIA, California Univ., Santa Barbara. Geography Remote Sensing Unit. J. E. Estes, L. W. Senger, and R. R. Thaman. In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Land Studies, p 308-317, 1972. 2 fig, 2 tab, 5 ref. NASA Grant 05-003-404.

Descriptors: \*Remote sensing, \*Aerial photography, \*Satellites (Artificial), \*Land use, California, Cities, Irrigation, Oil fields, Urbanization, Grazing, Surveys, Data collections.

Identifiers: \*ERTS.

The west side of the San Joaquin Valley, an arid region, is undergoing intensive agricultural development and changes in existing extensive land-use patterns. Land-use changes were studied land-use patterns. Land-use changes were studied from high altitude photography and ERTS-1 data. An overall regional change pattern shows changes from an oil-producing and grazing area into a cropping region. ERTS-1 data, acquired over shorter intervals of time, should provide more information on: nature of change; location of change; magnitude of change; direction of change; and rate of change. (See also W73-14326) (Knapp-IISGS) USGS) W73-14345

GEOGRAPHIC INVESTIGATIONS SOCIATED WITH THE EROS PROGRAM OF THE DEPARTMENT OF THE INTERIOR, Geological Survey, Washington, D.C. Geographic Applications Program. J. L. Place.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 318-327, 1972. 5 fig.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Land use, Cities, Urbanization, Data col-Identifiers: \*ERTS, \*U.S. Geological Survey.

The Geographic Applications Program of the USGS is evaluating the utility of satellite images, supplemented by high altitude aerial photographs, supplemented by high altitude aerial photographs, for studying the changing patterns of man's activities on the earth's surface. This would include such things as land use, population changes, or air and water pollution. Urban mapping is being done at a scale of 1:100,000. Among the 26 cities studied are Phoenix and Tucson. In all approaches to land use monitoring, a computerized information system is being developed to relate land use to a

variety of environmental or socioeconomic factors. A land use classification system is applicable in all 50 states, based upon primary use of high-altitude aerial photography or satellite imagery as major sources of information. (See also W73-14326) (Knapp-USGS) W73-14346

AUTOMATED PLOTTING AND UPDATE OF LAND USE MAPS AND RELATED INFORMA-TION IN SOUTH CENTRAL ARIZONA, Geological Survey, Washington, D.C. Geographic Applications Program. For primary bibliographic entry see Field 07C. W73-14347

ON **GEOLOGIC-TERRAIN** MAPPING FOR LAND-USE PLANNING IN THE TUCSON AREA, Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.

RESEARCH FOR APPLICATION OF REMOTE SENSING TO STATE AND LOCAL GOVERN-MENTS (ARSIG), Arizona Univ., Tucson, Office of Arid Lands Stu-For primary bibliographic entry see Field 07C. W73-14349

REMOTE SENSING OF IRRIGATION TECHNIQUES AND CROP PATTERNS IN THE DOUGLAS BASIN, ARIZONA, J. Altenstadter, and K. Foster.
In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 374-379, 1972. 1 tab.

Descriptors: "Remote sensing, "Land use, "Crops, Irrigation, Return flow, Farms, Vegetation, "Arizona. Identifiers: "Douglas basin (Ariz).

A joint study between the Office of Arid Lands Studies, University of Arizona, the Cochise County Planning Department, and the Whitewater Draw Natural Resource Conservation District investigation had three objectives: (1) to determine remote sensing responses of various irrigation techniques in the Douglas Basin that potentially contribute to the tail-water runoff problem; (2) attempt to discriminate four major crop types; and (3) determine the amount of land that has been set aside as fal-low, idle, or retired from agricultural production. A multistage sensing design consists of (1) ground truth; (2) medium altitude (10,000 ft) thermal imagery and color infrared photography; and (3) ERTS-1 satellite imagery. Seven target areas were chosen in the area as a basis from which detailed runoff monitoring and crop type discrimination could be expanded to other areas. Fallow or idle fields could be delineated best, with orchards next. Affalfa was correctly discriminated 72% of the time. Cotton and small grain proved the most difficult to discriminate using the color infrared photography. (See also W73-14326) (Knapp-USGS) W73-14350

DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO, Geological Survey, Arlington, Va.

E. J. Pluhowski. Available from NTIS, Springfield, Va 22151 as E-73-10316 Price \$3.00 printed copy; \$1.45 microfiche. Contract report for Goddard Space Flight Center, January 1, 1973. 6 p.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Turbidity, \*Lake Ontario, Suspended load,

Data collections, Surveys, Mapping, Path of pollu-Identifiers: \*ERTS, Welland Canal, Niagara River, Oswego River.

The suspended sediment plumes generated by the Welland Canal and the Genesee River are identifiable in most band 5 frames received from ERTS-1. In descending order of value for plume detection in Lake Ontario are bands 4, 6, and 7. Little or no information content relative to plume detection is available in band 7. The Oswego River plume was not visible during low flow periods; however, it was identifiable immediately following storms. Increased suspended sediment loading emanating from storm runoff increases turbidity levels to the oint where the plume becomes visible in the ERTS imagery. Despite the fact that it is detectable from high-altitude (60,000 ft) photography, the Niagara River plume was not visible in any of the ERTS-1 frames. Numerous examples of shoreline erosion were evident in the December 7, 1972, imagery of western Lake Ontario. Near-shore lake circulation patterns are usually apparent whenever turbidity plumes are sensed by the satellite. (K-napp-USGS) W73-14354

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS, Texas Tech Univ., Lubbock. Dept. of

Geosciences. C. C. Reeves, Jr.

C.C. Reeves, Jr. Available from NTIS, Springfield, Va 22151 as E73-10455 Price \$3.00 printed copy; \$1.45 microfiche. NASA contract report for Goddard Space Flight Center, March 31, 1973. 9 p, 3 fig.

Descriptors: \*Water balance, \*Ecosystems, \*Limnology, \*Texas, \*New Mexico, Playas, Lakes, Lake morphology, Remote sensing, Aerial photography, Satellites (Artificial), Data collections, Computer programs, Data processing, Correlation analysis, Photography, Water level fluctuations.

The objective of this project is to correlate ERTS-I satellite imagery signatures with the water balance ecosystem and geology-morphology of select lake basins in west Texas. Optical analysis of MSS imagery shows that water fluctuations in large lake basins, such as the Double Lakes site, can be monitored. Also, satellite imagery can be utilized to give a wet census of the number of small lake basins which contain water on any one pass. This becomes advisable, from a time and monetary standpoint, where areas, such as the Southern High Plains, contain tens of thousands of lake basins. Individual storm paths can also be traced. A wet census can also be taken from CCT data, but ground-truth correlation must be conducted in order to determine the number of computer classifications to utilize for differentiation of water from wet muds. (Woodard-USGS)

REMOTE SENSING OF WATER QUALITY: A STATE OF THE ART REPORT, Florida Univ., Gainesville. Dept. of Environmen-For primary bibliographic entry see Field 05A.
W73-14363

STRIP-MINED WATERSHED HYDROLOGIC DATA ACQUISITION STUDY, Tennessee Univ., Knoxville. Dept. of Civil Engineering.
B. A. Tschantz.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-223 558, \$2.75 in paper copy, \$1.45 in microfiche. Water Resources Research Center, University of Tennessee, Knoxville, Research Report No. 35, 1973. 17 p, 13 fig, 6 ref. OWRR A-030-TENN (1). 14-31-0001-3843. Descriptors: \*Remote sensing, \*Strip mines, \*Aerial photography, Hydrologic data, \*Tennes-see, Mapping, Infrared radiation, Land use, Watersheds (Basins), Data collections. Identifiers: \*Data acquisition.

Remotely-sensed aerial photography of two small strip-mined East Tennessee watersheds was used as a means for obtaining land-use information esential to econometric and hydrologic studies and for reclamation practice surveillance. 1:12,000 scale maps were produced for both watersheds from three color IR photographic flights. Other available high altitude photography and thermal imagery data were used to help map strip-mine disturbed areas. Excellent photographic coverage and quality permitted approximately 5.041 acres of and quality permitted approximately 5,041 acres of watershed, representing 847 acres of distrubed bench, slope, and slide areas to be mapped for each mission at a cost of less than 10 cents/acre. The study demonstrated the usefulness of using low altitude IR photography for identifying, mapping, and measuring strip-mine disturbance W73-14368

OPTIMAL IDENTIFICATION OF AQUIFER PARAMETERS IN A DISTRIBUTE SYSTEM, California Univ., Los Angeles. Dept. of Engineer-For primary bibliographic entry see Field 02F. W73-14375

IDENTIFICATION OF PARAMETERS IN FINITE LEAKY AQUIFER SYSTEM, California Univ., Los Angeles. Dept. of Engineering Systems. For primary bibliographic entry see Field 02F. W73-14376

GUIDE TO OPERATION AND MAINTENANCE OF THE AUTOMATIC PARTICLE SIZE ANALYZER, Rocketdyne, Canoga Park, Calif. For primary bibliographic entry see Field 03A. W73-14380

THE APPLICATION OF GAS CHROMATOGRAPHY OF VOLATILE METAL CHELATES TO WATER ANALYSIS, Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 02K. W73-14393

ARCTIC SEA ICE RIDGE FREQUENCY DIS-TRIBUTIONS DERIVED FROM Naval Oceanographic Office, Washington, D.C. Polar Oceanography Div.
For primary bibliographic entry see Field 02C. W73-14408

DIRECT VAPORIZATION AND QUANTIFICA-TION OF ARSENIC FROM SOILS AND WATER, Texas A and M Univ., College Station. Dept. of Agricultural Analytical Services; and Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences. For primary bibliographic entry see Field 05A. W73-14416

RESPONSE OF SALINITY SENSORS TO RAPIDLY CHANGING SALINITY, Agricultural Research Service, Riverside, Calif. Salinity Lab. For primary bibliographic entry see Field 02G.

### Field 07-RESOURCES DATA

#### Group 7B-Data Acquisition

A COMPARISON BETWEEN MERCURY IN-JECTION AND NITROGEN SORPTION AS METHODS OF DETERMINING PORE SIZE

METHODS OF DEFENDANCE OF SOIL STREET AUSTRALIA Univ., Nedlands. Dept. of Soil Science and Plant Nutrition.
For primary bibliographic entry see Field 02G.

COINCIDENCE AND INTERFERENCE COR-RECTIONS FOR DUAL-ENERGY GAMMA RAY MEASUREMENTS OF SOIL DENSITY AND WATER CONTENT, Florida Univ., Gainesville. Dept. of Soil Science.

For primary bibliographic entry see Field 02G. W73-14424

NEW METHOD FOR EVALUATION OF DIS-SOLVED OXYGEN PROBE RESPONSE FOR K SUB L A DETERMINATION, California Univ., Berkeley. Lawrence Berkeley

For primary bibliographic entry see Field 05A. W73-14452

A PHOTON COUNTING DEVICE FOR THE MEASUREMENT OF NANOSECOND AND MICROSECOND KINETICS OF LIGHT EMISSION FROM BIOLOGICAL SYSTEMS, MSU-AEC Plant Research Lab., East Lansing,

For primary bibliographic entry see Field 05A.

MATHEMATICAL ANALYSIS OF A HEAT EXCHANGE THAT CAN BE CONTROLLED BY COMPUTER (ANALYSE MATHEMATIQUE D'UN ECHANGEUR DE CHALEUR QUI CON-VIENT AU CONTROLE PAR ORDINATEUR), National Inst. of Scientific Research, Quebec. For primary bibliographic entry see Field 02C. W73-14470

MEASUREMENT OF FLOOD FLOW AND SUSPENDED SEDIMENTATION BY RADIOISOTOPE METHOD,

Taiwan Power Co., Taipei.
D. S. L. Chu, C. F. Pan, and I. L. Cheng.
Final Report November, 1972. 36 p, 10 fig, 11 tab,
2 appendices. IAEA No. 644/RB.

Descriptors: "Flood flow, "Flow measurement, "Suspended solids, "Instrumentation, On-site tests, Analytic techniques, Sampling, Radioisotopes, Sedimentation, Sediment transport, Flow rates, Flood peak, Flood data, Flood discharge, Current meters Identifiers: \*Taiwan.

The use of radioisotopes to measure flood flow and suspended sediment was studied in Taiwan. Flood flows were studied by comparison of results of the measurement of flows using tritium, the bromide isotope method, the chromium isotope EDTA method, and by the current-meter method. The use of tritium was found to be an acceptable method for flow measurement, but the low cost of the current meter method makes this method the most preferable. The use of tritium was found to most preterable. The use of tritium was found to be most effective for a mixing length, in meters, equal to 200 times Q 2/3, where Q is the river flow in cubic meters per second. A dosage of one curie per 20cubic meters per second of flow was found to be best. Suspended solids is an important factor. in Taiwan water management, because rainfall is heavy (about 250 cm a year) and erosion occurs easily due to weak geological formations. Various sediment gauges have been tried, but they are dif-ficult to operate under the Taiwan conditions. The radioisotope gauge proved to be of no advantage, although improvements in sensitivity and stability may make it usable. (Poertner)

METHOD OF RANDOMLY DISTRIBUTING GRAINS FOR MICROSCOPIC EXAMINATION. Oregon State Univ., Corvallis. School of Oceanog-

For primary bibliographic entry see Field 02J. W73-14574

INEXPENSIVE DUAL BEAM TURBIDIMETER, Rochester Univ., N.Y. Inst. of Optics. For primary bibliographic entry see Field 02J. W73-14575

THE CIRCULATION OF PRINCE WILLIAM

Alaska Univ., College. Inst. of Marine Science. For primary bibliographic entry see Field 02L. W73-14588

ESTUARINE AND COASTAL WATER DYNAMICS CONTROLLING SEDIMENT MOVEMENT AND PLUME DEVELOPMENT IN LONG ISLAND SOUND,

Geological Survey, Hartford, Conn. For primary bibliographic entry see Field 02L. W73-14590

NEW METHOD OF FORECASTING MUD-FLOWS FROM THUNDERSTORMS (NOVYY METOD PROGNOZIROVANIYA SELEVYKH POTOKOV PO GROZAM), Akademiya Nauk SSSR, Moscow. Institut

Geografii.

For primary bibliographic entry see Field 02J. W73-14599

TIME SENSING AND ANALYSIS OF COASTAL

WATERS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02L.
W73-14631

EXPERIMENTAL STUDY OF WATERFLOOD

TRACERS, Jersey Production Research Co., Tulsa, Okla. For primary bibliographic entry see Field 02E. W73-14727

A CIRCUIT FOR A SELF-TIMING STOMATAL

DIFFUSION POROMETER, New South Wales Inst. of Technology, Sydney (Australia). School of Life Sciences. For primary bibliographic entry see Field 02I. W73-14747

#### 7C. Evaluation, Processing and Publication

MATHEMATICAL SIMULATION OF AM-MONIA STRIPPING TOWERS FOR WASTE-

WATER TREATMENT,
Federal Water Quality Administration, Cincinnati,
Ohio. Advanced Waste Treatment Research Lab. For primary bibliographic entry see Field 05D. W73-14229

MACHINE-PLOTTED PROBABILITY CHARTS, Sandia Lab., Albuquerque, N.M. H. E. Anderson.

Journal of Quality Technology, Vol 5, No 3, p 135-137, July 1973. I fig, 1 tab, 4 ref.

Descriptors: \*Data processing, \*Computer programs, \*Probability, Statistical methods. Identifiers: Plotting.

A computer program is presented which can plot comulative probability charts. The program as-sumes that the mean and standard deviation have

been calculated and that the sample data have been arranged in ascending order. The maximum sample size is 1000 with the program as presently written. (Little-Battelle) W73-14282

THERMAL REMOTE SENSING ON THE MIS-SISSIPPI RIVER IN IOWA, Geological Survey, Iowa City, Iowa.

For primary bibliographic entry see Field 05A. W73-14286

INTERNATIONAL CONFERENCE REMOTE SENSING IN ARID LANDS, Arizona Regional Ecological Test Site, Tucson.

Artzona Regional Ecological Test Stay, Visional Le. K. Lepley.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 1-11, 1972. 1 fig.

Descriptors: \*Remote sensing, \*Arizona, \*Arid lands, Land use, Satellites (Articifical), Geologic lands, Land use, Satellites (Articlical), Geologic mapping, Exploration, Mapping, Urbanization, Vegetation, Phreatophytes, Data collections, Ero-sion, Grazing, Oceanography, Farms, Snow cover, Ecology. Identifiers: \*Arizona Regional Ecological Test

The Arizona Regional Ecological Test Site (ARETS) was created in late 1970 by the Department of Interior's EROS program and the University of Arizona at the request of the NASA. The purpose of its formation was to establish a center which would include a remote sensing data library, then facilities and equipment for analysis of the data, and a staff who could probide remote sensing expertise. Equipment available for use includes a video density analyzer to convert photographic video density analyzer to convert photograp density levels into contoured density steps a automatically measure areas. The multispectral viewer combines black and white photography to produce color or false-color images. (See also W73-14326) (Knapp-USGS) W73-14327

ORBITAL AND AERIAL (RB-57) PHOTOGRAPHY FOR MAPPING SOILS AND GEOLOGY IN SEMI-ARID WEST TEXAS AND EASTERN IN SEMI-AND NEW MEXICO, Toyas Tech Univ., Lubbock. Dept. of

Texas Tech Geosciences. B. L. Allen

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 12-45, 1972. 22 fig, 6 ref.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Arid lands, Texas, New Mexico, Geologic mapping, Mapping, Surveys, Palyas, Data collections, Aerial photography.

Identifiers: \*ERTS.

Apollo 9 orbital photography and RB-57 overflight photography were used to map soils and geologic features in the west Texas-eastern New Mexico area. The RB-57 overflights were useful for distinguishing areas of brown, gray, red, black, and white soils and revealed several alignments of playa lake basins. Apollo photography was par-ticularly useful for gross geologic relationships such as lineament studies, highly generalized soil such as lineament studies, highly generalized soil mapping, and regional distribution of cultural patterns. Previously undiscerned features on both types of photography could be mapped if the photos were compared to soil surveys and geologic maps of the area. Preliminary examination of ERTS-1 MSS imagery indicates that resolution and definition is adequate for general soils maps and regional geologic studies. Identifiable resolution for high contrast linear objects is on the order of a foot. (See also W73-14326) (Knapp-USGS) W73-14328

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Compa structu ized re or fra Cordil the m areas a forms lated to metalli Range cury d EVALUATION OF ERTS-1 IMAGERY FOR AN INVENTORY OF POST-1890 ACCELERATED

INVENTORY OF FUSI-1899 ACCESSES AND INVENTORY OF FUSION OF THE PROPERTY OF T

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Erosion, \*Arid lands, Grasslands, Mapping, Surveys, Vegetation, Soil erosion, Alluvial channels, Sedimentation, Data collections. Identifiers: \*ERTS.

ERTS-1 imagery was used to inventory the effects of an episode of accelerated erosion that began in southern Arizona about 80 years ago. Around 1890 the larger streams in this region started actively to the larger streams in this region started actively to downcut their channels, bringing to an end an epidose of generally sluggish episode that had lasted for about 4,000 years. The accelerated ero-sion still continues unabated and poses an ecologi-cal-environmental problem of great importance to cal-environmental problem of great importance to this region. Causes of the post-1890 erosion still are not fully understood. Four principal causes have been hypothesized: overgrazing, adverse climatic change, reduction of burning of the rangeland, and increase in rodent and jack rabbit population. Overgrazing and climatic change are the two chief factors, and they probably acted together. A fundamental change has taken place in the plant ecology of the whole desert grassland region: grass has steadily declined in abundance and abrubs have increased markedly on the desert gion: grass has steadily declined in abundance and shrubs have increased markedly on the desert plains and foothills (notably mesquite but also bur-roweed, rabbitbrush, ocotillo, catclaw, and white thorn). ERTS imagery is used to evaluate the present status of post-1890 erosion in the Desert Grassland region, the rates of its increase in representative areas, its causal factors, and the degree of success of past and present ameliorati measures. (See also W73-14326) (Knapp-USGS) W73-14329

THE NOAA/NESS PROGRAM OF REMOTE SENSING OF SOIL MOISTURE, National Environmental Satellite Service,

Washington, D.C.
For primary bibliographic entry see Field 07B.
W73-14330

METALLOGENIC SIGNIFICANCE ALASKAN GEOSTRUCTURES SEEN ON NIM-BUS AND ERTS IMAGES, E. H. Lathram.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 76, 1972.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Structural geology, \*Geologic mapping, Exploration, Surveys, Mining, Data collections, \*Alaska. Identifiers: \*ERTS.

The northeast- and northwest-trending set of traces of crustal structures shown on Nimbus images also appears on ERTS images of Alaska. Comparison of this set of structures with the distribution of mineral deposits and known major structures yields some interesting relations. In the Canadian Cordillera, the development of mineral deposits and structures are structures and the structures are structured to the structure of ized regions seems related to major crustal zones or fractures trending southwestward across the Cordillera from the Precambrian shield. In Alaska, the mineralized region of massive sulfides in Prince William Sound and upper Copper River areas and of porphyry coppers in the Nabesna area forms a broad northeast-trending belt possibly related to the Minto Arch on the shield. The belt of metalliferous deposits in the western Alaska Range follows a comparable northeast trend. Mer-cury deposits, together with most antimony and

tungsten deposits, occupy a northeast-trending belt between the Bristol Bay-Mackenzie Bay linear and extensions of a linear along the lower Yukon River. This belt intersects the northwesttrending Canadian belt of similar deposits in the Fairbanks area. (See also W73-14326) (Knapp-USGS) W73-14331

BASIC CONSIDERATIONS OF HIGH RESOLU-TION SIDE-LOOKING RADAR IMAGERY, Goodyear Aerospace Corp., Litchfield Park, Ariz. Sensor Applications Engineering. For primary bibliographic entry see Field 07B. W73-14332

THE APPLICATION OF RADAR AND INFRARED IMAGERY TO QUANTITATIVE GEOMORPHOLOGICAL PROBLEMS, Texas Univ., Austin. Bureau of Economic Geological Programme (1988).

For primary bibliographic entry see Field 07B. W73-14333

APPLICATION OF A DIRECTIONAL REFLECTANCE MODEL TO WHEAT CANO-PIES UNDER STRESS,
Michigan State Univ., East Lansing. Dept. of For primary bibliographic entry see Field 07B. W73-14334

MULTISPECTRAL REMOTE SENSED IMAGE ANALYSIS BY A SPECIAL ELECTRONIC

Stanford Research Inst., Menlo Park, Calif. For primary bibliographic entry see Field 07B. W73-14338

PRODUCTION OF THEMATIC MAPS BY OPTI-CAL ANALOG PROCESSING OF COLOR TRANSPARENCIES,

Arizona Univ., Tuscon. Optical Sciences Center. For primary bibliographic entry see Field 07B. W73-14339

A COMPUTER PROGRAM FOR GENERATING SCATTERGRAMS ON THE CALCOMP

PLOTTER, Arizona Univ., Tucson. Dept. of Geography and Area Development.

F. T. Aldrich In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 216-231, 1972. 12 fig, 3 ref.

Descriptors: \*Data processing, \*Computer programs, \*Charts, \*Statistical methods, Statistics, Correlation analysis, Regression analysis. Identifiers: \*Scattergrams, \*Data plotting.

A computer graphics system produces two-dimensional scattergrams on a moderately-sized digital computer and digital increment plotter. Scattercomputer and digital increment plotter. Scatter-grams produced by this program are of publishable quality. The magnetic tape used to generate the graphs may be saved and played repeatedly to produce multiple copies for research distribution or final copy for reproduction. Accompanying the plotted output is a printed summary of the opera-tions performed. The program also allows overlays of multiple sets of data plotted with different sym-bols for comparing similar information. (See also W73-14326) (Knapp-USGS)

REMOTE ANALYSIS OF AIRBORNE PARTI-

CLES BY POLARIMETRY, Arizona Univ., Tucson. Lunar and Planetary Lab. For primary bibliographic entry see Field 07B.

W73-14341

THE APPLICATION OF SPACE IMAGERY TO ANTHROPOLOGY, New Mexico Archeological Center. For primary bibliographic entry see Field 07B. W73-14342

THE KIN BINEOLA IRRIGATION STUDY: AN EXPERIMENT IN THE USE OF AERIAL REMOTE SENSING TECHNIQUES IN ARCHAEOLOGY, New Mexico Archeological Center. For primary bibliographic entry see Field 07B. W73-14343

AN INTERDISCIPLINARY EVALUATION OF ERTS POTENTIAL FOR ARID REGIONS, Nevada Univ., Reno. Renewable Resources Center. P. T. Tueller.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 284-307, 1972. I fig, I tab, 2

Descriptors: \*Remote sensing, \*Satellites (Artifi-California, Data collections.

Arid Lands, Deserts, Arizona, Aerial photography, Land use, Urbanization, Mapping, Recreation, Irrigation, Vegetation, Nevada, California, Data collections. Identifiers: \*ERTS.

Remote sensing from aircraft and spacecraft (ERTS-1) offers valuable supplemental source of information for the solution of land-use and environmental problems in arid regions. Much of the vironmental problems in and regions. Much of the arid region is being rapidly populated and growth and development is expected to continue at an ac-celerating rate. This offers a good opportunity to evaluate the impact of man on the land and water systems. Arid regions possibly offer greater poten-tial for the effective use of this imagery than many other parts of the country. The arid regions are generally cloud, smoke and haze free much of the generally cloud, smoke and haze free much of the year; they contain large homogeneous areas which are ideal for imagery calibration. A great variety of landforms are found in the desert and are often closely correlated with vegetation distribution, soil classification units, and land use and management. Data available for this study are NASA high flights (RB57P) in July of both 1970 and 1972. Red, green and blue bands, black and white infrared, color and color infrared multispectral data are available on 70 mm format at an approximate scale of on 70 mr format at an approximate scale of 1:432,000. Color and color infrared photographs are also available. (See also W73-14326) (Knapp-USGS) W73-14344

MONITORING THE EFFECTS OF A CHANG-ING RESOURCE BASE IN AN ARID LANDS AREA: THE WEST SIDE OF THE SAN JOAQUIN VALLEY, CALIFORNIA, California Univ., Santa Barbara. Geography Remote Sensing Unit. For primary bibliographic entry see Field 07B. W73-14345

GEOGRAPHIC INVESTIGATIONS AS-SOCIATED WITH THE EROS PROGRAM OF THE DEPARTMENT OF THE INTERIOR,
Geological Survey, Washington, D.C. Geographic
Applications Program.
For primary bibliographic entry see Field 07B.
W73-14346

AUTOMATED PLOTTING AND UPDATE OF LAND USE MAPS AND RELATED INFORMATION IN SOUTH CENTRAL ARIZONA, Geological Survey, Washington, D.C. Geographic Applications Program.

# Field 07—RESOURCES DATA

#### Group 7C-Evaluation, Processing and Publication

J. L. Place, and J. R. Wray.
In: Proceedings of the Third Annual Conference
on Remote Sensing in Arid Lands; Tucson,
November 1972: Arizona University Office of
Arid Land Studies, p 328-343, 1972. 10 fig.

Descriptors: \*Remote sensing, \*Satellites (Artificial), \*Land use, \*Mapping, Data processing, Arid lands, Cities, Urbanization, Data collections, Farms, Arizona Identifiers: \*ERTS, Phoenix (Ariz).

The Geographic Applications Program of the U.S. Geological Survey is participating in investigations in the Arizona Regional Ecological Test Site. This consists of land use mapping and change detection experiments at two different scales. A Calcomp 763 plotter was used to plot a land use map of the entire Phoenix Quadrangle. The urban and builtup areas around Phoenix are shown with different symbols representing cells for residential, com-mercial, industrial, urban open, transportation, nd quarrying. The agricultural land is shown with different symbols representing tree crops and nontree crops. Desert parkland is shown, as is military property. Overlain on this is the black culture plate of the standard topographic quadrangle. In this way, much time is saved in adding place names, boundaries, grids, and information. When data are processed by a computer, the land use and data of information for both the new and old information automation for both the new and old information are retained. In this way, trends can be monitored automatically. An updated map may be plotted automatically. (See also W73-14326) (Knapp-USGS) W73-14347

**PROGRESS GEOLOGIC-TERRAIN** ON MAPPING FOR LAND-USE PLANNING IN THE TUCSON AREA.

gical Survey, Denver, Colo.

R. B. Morrison.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies p 344-363, 1972. 6 fig.

Descriptors: \*Remote sensing, \*Terrain analysis, \*Geologic mapping, \*Hazards, Planning, Land use, \*Arizona, Mapping, Surveys, Identifiers: \*Flood mapping, \*Tucson (Ariz).

Land use planning should be founded on an inven-tory and appraisal of the whole natural environment, with an objective assessment of the various kinds of natural advantages and limitations. Also, different possibilities for land use at given sites should be tested according to systems concepts, so that unfavorable or hazardous situations or adverse environmental changes can be anticipated and avoided and the most desirable and least detrimental use of land can be promoted. The most fundamental environmental factors, other than climate, are geologic and terrain factors. Ranked in decreasing order of importance, they are: (1) topographic-geomorphic factors; (2) geologic factors; (3) hydrologic factors; and (4) soil factors. In most cases these geologic-terrain factors are more fun-damental and relevant to proper land-use planning than social, economic, and political considerations. A large area surrounding Tucson, Arizona, is rapidly undergoing development for residential, commercial, and industrial uses. The development is proceeding without a comprehensive regional plan for potential land uses. To aid in planning, geologic-terrain maps were made for the 1,300 square-mile area in and around Tucson. These maps are to be published at 1:125,000 scale. They are produced mainly by interpretation of ultrahig altitude color and color-infrared aerial photographs, controlled by available published and un-published reports and maps and by some addi-tional field observations. (See also W73-14326) (Knapp-USGS) W73-14348

RESEARCH FOR APPLICATION OF REMOTE SENSING TO STATE AND LOCAL GOVERN-MENTS (ARSIG), Arizona Univ., Tucson. Office of Arid Lands Stu-

K. Foster, and J. Johnson.

In: Proceedings of the Third Annual Conference on Remote Sensing in Arid Lands; Tucson, November 1972: Arizona University Office of Arid Lands Studies, p 364-373, 1972. 4 fig, 1 tab, 3

Descriptors: \*Remote sensing, \*Information exchange, Arizona, Planning, Universities, Governments. Identifiers: \*Technology transfer.

An interdisciplinary program is dedicated to the goal of remote sensing technology transfer and cooperation between faculty of the Office of Arid Lands Studies and local and state governmental entities interested in the application of remote sensing. The Advisory Committee is comprised of two University of Arizona representatives, two local governmental agency heads, two state agency personnel, and one federal employee involved in the EROS project. (See also W73-14326) (Knapp-USGS) W73-14349

REMOTE SENSING OF IRRIGATION TECHNIQUES AND CROP PATTERNS IN THE DOUGLAS BASIN, ARIZONA, For primary bibliographic entry see Field 07B. W73-14350

WATER RESOURCES OF WISCONSIN-LAKE

MICHIGAN BASIN, Geological Survey, Washington, D.C. E. L. Skinner, and R. G. Borman. For sale by USGS, Washington, D.C. 20242 \$1.50 per set. Hydrologic Investigations Atlas HA-432, 1973. 4 sheets, 42 ref.

Descriptors: \*Water resources, \*River basins, \*Lake Michigan, \*Hydrologic data, Streamflow, Runoff, Flow rates, Water yield, Water quality, Chemical analysis, Hydrologic cycle, Water de-mand, Water balance, Hydrologic budget, Water utilization, Precipitation (Atmospheric), Land use, Topography, Environmental effects, Maps, Irrigation, Planning.

This 4-sheet atlas describes the water resources of the Lake Michigan basin as an aid to water management. Described are the distribution, characteristics, and physical environment of the resource, as well as the hydrologic budget, water quality, water problems, and water use. The information will be used to select sites for systemati-cally monitoring the effects of a changing environment on the hydrology of the area. Data were gathered from various agencies and collected dur-ing field investigations. The Lake Michigan basin is a 3,600 square mile drainage area that lies along eastern Wisconsin and borders the western shore of Lake Michigan. It consists of several subbasins whose main stem streams discharge directly into Lake Michigan and into Green Bay. The study area does not include basins whose main stem streams discharge into Green Bay from the west and south. Included in the Lake Michigan basin are Door, Kewaunee, Manitowoc, Ozaukee, and Sheboygan Counties and parts of Brown, Calu-met, Fond du Lac, Kenosha, Milwaukee, Racine, Washington, and Waukesha Counties. (Woodard-W73-14351

STATUS OF FLOOD-PLAIN MAPPING, GREATER PITTSBURGH REGION, PENNSYL VANIA, 1972, Geological Survey, Carnegie, Pa. R. M. Beall, and A. C. Lardieri.

Open-file report, September 1972. 16 p, 1 map, 3 tab, 10 ref.

Descriptors: \*Floods, \*Flood plains, \*Mapping, Pennsylvania, Investigations, Progra Planning, Flood protection, Flood data, Maps. Identifiers: \*Pittsburgh region (Penn). Programs. WLGREW

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The purpose is to show the extent of recent floodmapping activity, the coverage by flood plain in-formation reports in the six-county Greater Pittsburgh region, and to provide summary informa-tion about the flood problems and flood investiga-tions of urban places within the region. The Greater Pittsburgh regional studies deal chiefly with the six western Pennsylvania counties of Allegheny, Armstrong, Beaver, Butler, Washington and Westmoreland. Old flood studies have not been searched or referenced on the map because peterns and zones of inundation are subject to change. Flood-prone areas may be altered by en-croachment from any or all sides, by channel im-provement or floodwall or levee construction, or by the natural or enhanced channel processes of scour and fill. The flood-mapping activities shown are those of the U.S. Army Corps of Engineers, U.S. Geological Survey, and U.S. Department of Agriculture Soil and Conservation Service. Flood plain information reports released through 1971 are listed. (Woodard-USGS) W73-14352

HISTORIC AND JUNE 1972 FLOOD ELEVA-TIONS, GREATER PITTSBURGH REGION, PENNSYLVANIA, Geological Survey, Carnegie, Pa.

R. M. Beall.

Open-file report, September 1972. 11 p, 1 fig, 1 map, 2 tab, 11 ref.

Descriptors: \*Floods, \*Flood stages, \*Peak discharge, \*Pennsylvania, Historic floods, Correlation analysis, Map, Hydrologic data, Flood data, Flood discharge, Streamflow, Gaging sta-

Identifiers: \*Pittsburgh region (Penn).

The flood of June 1972 was a notable one in a large part of the Greater Pittsburgh region. Tropical storm Agnes in late June 1972 had several pecu-liarities of behavior and effect. A six-county area (consisting of the Pennsylvania Counties of Allegheny, Armstrong, Beaver, Butler, Washington, and Westmoreland) can claim its share of notoriety because of the severe flooding in the eastern tributaries of the Allegheny and lower Youghiogheny Rivers. The combined effect was a flood of notable magnitude along the lower reaches of the Allegheny and Monongahela Rivers and in the Ohio River for some distance downstream from Pittsburgh. Storm runoff from the Beaver River basin and the upper Monon gahela was substantial but not unusual. Maps and tables show the extent by which the June flood ex-ceeded or was below flood stage. In places where a flood-stage figure has not been established or is not relevant to the definition of that term, the distance above or below bankfull stage is shown and listed, if available. Record-breaking flood heights were observed at the following mapped and listed sites: Clarion River at St. Petersburg, and Redstone Creek at Waltersburg. New record maximums (not listed) were also observed in the upper Mahoning River basin and in other headwater basins in the eastern half of the region. (Woodard-USGS) W73-14353

DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO, Geological Survey, Arlington, Va. For primary bibliographic entry see Field 07B.

WATER USE, CONSUMPTION, AND OUT-LOOK IN THE U.S. IN 1970, Geological Survey, Washington, D.C. Water Resources Div. For primary bibliographic entry see Field 06D.

STRIP-MINED WATERSHED HYDROLOGIC DATA ACQUISITION STUDY, Tennessee Univ., Knoxville. Dept. of Civil Engineering. For primary bibliographic entry see Field 07B. W73-14368

THE COMPUTER-SYSTEMS APPROACH TO ENVIRONMENTAL PROTECTION, PLANNING AND MANAGEMENT: THE MALIBU WATERSHED, California Univ., Los Angeles. School of Public Health.

For primary bibliographic entry see Field 05B.

W73-14371

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SONAR MAPPING OF THE UNDERSIDE OF PACK ICE, Wisconsin Univ., Middleton. Geophysical and Polar Research Center. For primary bibliographic entry see Field 02C. W73.1440P.

CALCULATION OF TURBIDIMETRIC MICROBIOLOGICAL VITAMIN ASSAY RESULTS, USING AN APL/360 COMPUTER PROGRAM, Food and Drug Administration, Washington, D.C.

Div. of Nutrition.
For primary bibliographic entry see Field 05A.
W73-14448

LAB AUTOMATION AT LOW COST, Digital Equipment Corp., Maynard, Mass. Lab. Data Products Group. D. Glover. Research Development, Vol 24, No 5, p 22-25,

May 1973. 3 fig.

Descriptors: \*Laboratory equipment, \*Costs,

Descriptors: \*Laboratory equipment, \*Costs, \*Automation, Computers, Instrumentation, Data storage and retrieval, Data transmission, Flexibility, Identifiers: \*Computer design.

This discussion covers those factors that must be considered in choosing a low cost laboratory computer system. Such a system may be either (1) a small system which is expandable to a medium size system or into a satellite interfaced to a large central system, as the lab requirements expand, or (2) a full-blown, time-shared system. This, of course, depends on the need of the laboratory, funding and the resources it commands. Those common elements that exist in the instrumentation in the laboratory should be considered in choosing from the variety of approaches available. The approach obviously depends on the desired end result and the decision as to how it should be attained. Computer output, data storage, and resolution enhancement are also very important considerations. (Holoman-Battelle) W73-14451

A PRELIMINARY BASELINE STUDY OF ROBERTS AND STURGEON BANKS, British Columbia Univ., Vancouver. Westwater Research Centre. For primary bibliographic entry see Field 05A. W73-14486 A PRELIMINARY WATER QUALITY SURVEY OF THE LOWER FRASER RIVER SYSTEM, British Columbia Univ., Vancouver. Westwater Research Centre. For primary bibliographic entry see Field 05A. W73.14487

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1971-NOVEMBER 30, 1972, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 04A. W73-14548

DECISIONS WITH INADEQUATE HYDROLOG-IC DATA. For primary bibliographic entry see Field 02A. W73-14550

AN ECONOMIC APPROACH FOR EVALUATING THE ADEQUACY OF HYDROLOGIC DATA,
Queen's Univ., Kingston (Ontario).
For primary bibliographic entry see Field 02A.
W73-14551

DESIGN OF HYDROMETRICAL NETWORKS AND APPLICATION TO COLOMBIA, World Meteorological Organization, Bogota (Colombia). For primary bibliographic entry see Field 02A. W73-14552

AN APPLICATION OF THE INADEQUATE HYDROLOGICAL DATA OF THE AFRICAN TROPICAL REGIONS IN ENGINEERING DESIGN, National Council for Scientific Research, Lusaka (Zambia).

For primary bibliographic entry see Field 02A.

W73-14553

IMPROVEMENT OF HYDROLOGICAL SER-VICES IN BOLIVIA, World Meteorological Organization, La Paz (Bolivia). For primary bibliographic entry see Field 07A. W73-14554

SHORT DURATION RAINFALL DEPTH-DUR-ATION-FREQUENCY MAP OF INDIA, Assam State Electricity Board, Barapani (India). For primary ibbliographic entry see Field 02A. W73-14555

COMPUTATIONS OF PEAK FLOODS WITH IN-ADEQUATE HYDROLOGIC DATA, Columbia Univ., New York. For primary bibliographic entry see Field 02A. W73-1456

DETERMINATION OF SOME HYDROLOGI-CAL FACTORS WITH A WELL RECORDER, Ain Shams Univ., Cairo (Egypt). For primary bibliographic entry see Field 02A. W73-14557

THE USE OF TRACER DATA IN INCREASING THE INFORMATION ON HYDROLOGIC SYSTEMS, Weizmann Inst. of Science, Rehovot (Israel). Isotope Dept. For primary bibliographic entry see Field 02A. W73-14558

CONCEPT OF A TECHNIQUE FOR AN ANALY-SIS OF WATERSHED RUNOFF EVENTS, Agricultural Research Service, Riesel, Tex. Soil and Water Research Div. For primary bibliographic entry see Field 02A. W73-14559

EXPERIENCE WITH A MONTHLY RAINFALL-RUNOFF TRANSFER FUNCTION MODEL, Lahmeyer International G.m.b.H., Frankfurt am Main (West Germany). For primary bibliographic entry see Field 02A. W73-14566.

THE USE OF EVOP AS A HYDROLOGIC TOOL, British Columbia Univ., Vancouver. Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14561

A SIMULATION TECHNIQUE OF MONTHLY RUNOFF BY USE OF PRECIPITATION TIME SERIES AT MULTISTATIONS, Hokkaido Univ., Sapporo (Japan). Dept of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14562

ON THE USE OF SHORT-TERM DATA FOR STREAMFLOW SYNTHESIS, Pittsburgh Univ., Pa. Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14563

A SIMILAR STORM METHOD ON FILLING DATA VOIDS, Tokushima Univ., (Japan). Dept. of Engineering. For primary bibliographic entry see Field 02A. W73-14564

ANALYSIS OF MONTHLY RAINFALL PROBA-BILITIES BY WEIGHTED TRANSFORMA-TION, Engineering Consultants, Inc., Denver, Colo. For primary bibliographic entry see Field 02A. W73-14565.

EVALUATION OF MULTIANNUAL FIRM HYDROELECTRIC POWER—A NEW METHOD, Hidrotecnica Portuguesa, Lisbon. Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14566

INADEQUATE HYDROLOGIC DATA AND RESERVOIR CAPACITY, Monash Univ., Clayton (Australia). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14567

EFFECTS OF INADEQUACE OF HYDROLOGIC DATA ON RELIABILITY OF WATER RESOURCES DESIGN,
Osaka Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W73-14568

EVALUATION OF DROUGHT EFFECTS AT LAKE ATITLAN, Hydrologic Engineering Center, Davis, Calif. For primary bibliographic entry see Field 02A. W73-14569

# Field 07—RESOURCES DATA

#### Group 7C-Evaluation, Processing and Publication

THE HYDROLOGICAL FEASIBILITY OF VARIABLE WATER SUPPLY POLICIES, Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Research and Development Div. For primary bibliographic entry see Field 02A. W73-14570

AN APPRAISAL OF THE SIGNIFICANCE OF SIEVE INTERVALS IN GRAIN SIZE ANALYSIS FOR ENVIRONMENTAL INTERPRETATION, Institute of Oceanographic Sciences, Taunton (England).
For primary bibliographic entry see Field 02J.
W73-14576

OCEANOGRAPHY (OKEANOGRAFIYA).
Far Eastern Hydrometeorological Research Inst., Vladivostok (USSR).
For primary bibliographic entry see Field 02L.
W73-14597

GLACIER PULSATIONS AND PROBLEM OF PREDICTING THEM ON THE MEDVEZHIY GLACIER (PUL'SATSII LEDNIKOV I PROBLEMA IKH PROGNOZIROVANIVA NA PRIMERE LEDNIKA MEDVEZH'YEGO (ZAPADNYY PAMIR)), Akademiya Nauk SSSR, Moscow. Institut

Geografii.
For primary bibliographic entry see Field 02C.
W73-14600

THEORETICAL ANALYSIS OF THE ROLE OF SUBSURFACE FLOW IN THE GENERATION OF SURFACE RUNOFF: 2. UPSTREAM SOURCE AREAS, IBM Watson Research Center, Yorktown Heights,

N.Y.
For primary bibliographic entry see Field 02A.
W73-14608

INVESTMENT CRITERIA AND MATHEMATI-CAL MODELLING TECHNIQUES FOR WATER RESOURCES PLANNING IN ARGENTINA: THE MIT-ARGENTINA PROJECT, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

Civil Engineering. For primary bibliographic entry see Field 06A. W73-14670

A SYSTEMS APPROACH TO SOLID WASTE MANAGEMENT IN ASIA: BANGKOK, THAI-LAND, AS A CASE STUDY, Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering. For primary bibliographic entry see Field 05D. W73-14674

HYDROLOGIC SIMULATION.
Lake County Regional Planning Commission,
Waukegan, Ill.
For primary bibliographic entry see Field 04A.
W73.14685

### 08. ENGINEERING WORKS

#### 8A. Structures

PROCEEDINGS - SIXTEENTH ANNUAL WATER CONFERENCE.
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 04A. W73-14224

FLOOD CONTROL REPORT, CASA GRANDE, ARIZONA, 1973. Henningson, Durham and Richardson, Inc., Phoenix, Ariz. For primary bibliographic entry see Field 04A. W73-1447.

OBION AND FORKED DEER RIVERS AND TRIBUTARIES, TENNESSEE AND KENTUCKY, INTERIM REPORT: HARRIS FORK CREEK. Army Engineer District, Memphis, Tenn. For primary bibliographic entry see Field 04A. W73-14502

CANAL BANK RETAINING WALL MEANS AND METHOD, P. R. Jacobs, and M. L. Jacobs.

P. R. Jacobs, and M. L. Jacobs. U. S. Patent No. 3,744,255, 5 p, 7 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 912, No 2, p 454, July 10, 1973.

Descriptors: \*Patents, \*Canal construction, Engineering structures, \*Concrete-lined canals, Ecology, \*Canal embankments, Recreation, Natural resources, Cast-in-place structures.

A concrete inclined canal bank retaining wall and method of constructing it are described. A canal is dug with inclined earthern banks. The concrete inclined retaining wall is poured onto the banks immediately after the canal is dug and before the canal becomes filled with water or the banks deteriorate because of rain storms or wave action. Expansion joints at spaced intervals along the length provide for expansion and contraction of the retaining walls upon changes in ambient temperatures. The sloping wall surface may be roughened to provide niches for sheltering marine life. (Sinha-OEIS)

WATER SUPPLY PROJECTS IN DEVELOPING COUNTRIES, Parsons (Ralph M.) Co., Los Angeles, Calif. For primary bibliographic entry see Field 04A.

#### 8B. Hydraulics

ROUND HORIZONTAL THERMAL-BUOYANT JET IN A CROSS FLOW, Washington Univ., Seattle. Dept. of Civil Engineering. For primary bibliographic entry see Field 05B. W73-14212

A MATHEMATICAL MODEL OF WATER AD-VANCE AND FLOW IN SMALL EARTH CHAN-NELS, Washington State Univ., Pullman. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 04A. W73-14369

LANCASTER COUNTY PLANNING COMMIS-SION: STORM DRAINAGE STUDY. Weston (Roy F.), Inc., West Chester, Pa.

August 1970. 24 p, 10 ref, 3 append.

Descriptors: \*Storm drains, \*Storm runoff, Runoff, \*Design criteria, \*Drainage systems, Drainage, Environmental effects, Sewers, Drains, \*Pennsylvania. Identifiers: Storm intensity, \*Lancaster County

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Design criteria are recommended which will provide the basis for the design of adequate storm drainage facilities for suburban, urban, industrial,

and agricultural areas of Lancaster County, Pennsylvania, where growth has changed many of its areas from principally rural-farm orientation to a commercial-residential nature. An inventory is provided of the existing major storm drainage systems within the county and the scope of a future storm sewer report of a more comprehensive nature is suggested. Included within the recommended design criteria for storm drainage facilities are the basic runoff equations for the determination of the volume of runoff, using the 'Rational Method,' runoff coefficients relative to the various types of surfaces, and storm intensity duration curves for various frequency storms based on data supplied by U. S. Weather Bureau records. Gutter flow and inlet location, and erosion control are discussed. Maps relating to the major and minor sewer systems in the county are included. (Edwards-North Carolina) W73-14490

LASER DOPPLER VELOCITY MEASURE-MENTS OF SWIRLING FLOWS WITH UP-STREAM INFLUENCE,

California Univ., Santa Barbara.
K. L. Orloff, and H. H. Bossel.
Available from NTIS, Springfield, Va 22151 as
NASA CR-2284 Price \$3.00 printed copy; \$1.45
microfiche. National Aeronautics and Space Administration Contractor Report NASA CR-2284,
July 1973. 42 p, 12 fig, 3 plate, 24 ref. NGR 05-010-

Descriptors: "Rotational flow, "Vortices, "Fluid mechanics, Analytical techniques, Velocity, Anemometers, Instrumentation, Flow measurement, Theoretical analysis, Equations, Reynolds number, Correlation analysis, Streamflow. Identifiers: "Laser-doppler anemometer.

Swirling flow in a rotating tube is studied by flow visualization at a moderate Reynolds number, and tits velocity field is measured by laser-Doppler anemometry. The tube has constant diameter, and approximately uniform initial rigid rotation of the flow is assured by passing the flow through a rotating plug of porous metal before it enters the test section. At moderate swirl values, an object mounted on the tube centerline causes a closed bubble to form upstream of the obstacle, with a clearly defined stagnation point on the axis, and recirculating flow inside the bubble. The bubble length grows upstream as the swirl is increased, until it breaks up into a Taylor column reaching all the way upstream and downstream at swirl values above a certain critical value. A vortex jump (in the sense of Benjamin) occurs downstream of the obstacle except when the Taylor column is present. Using a laser Dopper anemometer, axial and swirl velocity profiles are obtained at several stations upstream and downstream of the bubble, and in and around the bubble. The experimental velocity profiles, the stream surface plots, and the velocity distribution on the axis are compared with the corresponding results of solutions to the equation of inviscid rotating flow. (Woodard-USGS) W73-14571

PROBLEMS OF GROUNDWATER USE AND CONSERVATION IN LITHUANIA (VOPROSY ISPOL'ZOVANIYA I OKHRANY PODZEMNYKH VOD YUZHNOY PRIBALTIKI). For primary bibliographic entry see Field 04B. W73-14606

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WAVE MEASUREMENTS OFF OXNARD, CALIFORNIA, Naval Civil Engineering Lab., Port Hueneme,

Calif. W. E. Hoffman.

Available from the National Technical Information Service as AD-451 129, \$6.00 in paper copy, \$1.45 in microfiche. Report No. NCEL-TN-530, August 1964. \$2 p., 33 fig, 6 tab, 5 ref.

Descriptors: \*Breakwaters, \*Harbors, Jetties, Descriptors: "Breakwaters, "Harbors, Jetties, Beaches, "Coastal engineering, "Waves (Water), Equipment, Ocean waves, Engineering structures, "Sediment transport, "California. Identifiers: Nearshore processes, Sand bypassing, "Littoral sand drift, Beach stabilization, Sand transport, Oxnard (Calif).

A description is presented of a mainly water level A description is presented of a mainly water level (wave) measuring complex in about 18 feet of water behind and in the vicinity of an off-shore breakwater for a small craft harbor. The breakwater serves as a trap for sand which is by-passed periodically around the jetties of a major harbor behaviorate with descriptions. periodically around the jettles of a major harbor about one mile downshore (Port Hueneme, California). Instruments and methods are discussed for the complex as progressively improved over a 10 year period beginning in 1953. Types of measurements are presented with typical daily average: Surface water level variation from three stations-height 1.5 feet and period of 11.3 records: water level persons the first progressive of the present the seconds: water leaves the first present the seconds: water leaves the first persons the seconds: water leaves the first present the seconds: water leaves the first persons the seconds: water leaves the seconds water leaves water leaves the seconds water leaves water leaves water leaves water lea seconds; water temperature 60 degrees F; breaking wave height 2.9 feet and 6.5 period; littoral current velocity-SE set at 60 feet/minute-wind velocity on-shore at 15 knots. The beach and sea surface were recorded on photographs periodi-cally. All data collected was sent to Coastal Engineering Research Center for analysis and report-ing. The data are intended to improve the un-derstanding of behavior of waves and beaches bederstanding of behavior of waves and beaches behing and in the vicinity of an off-shore breakwater. Effective July 1964, the Los Angeles District of the Corps of Engineers assumed responsibility for the complex. The information presented is considered useful mainly to those planning subject type installation. (Sinha-OEIS) W73-14625

LABORATORY STUDY OF SEICHING INDUCED ON AN OFFSHORE SHELF, Naval Civil Engineering Lab., Port Hueneme,

L. E. Robson, and D. B. Jones. Available from the National Technical Informa-tion Service as AD-653 711, \$6.00 in paper copy, \$1.45 in microfiche. NCEL Technical Note N-895, February 1967. 46 p, 25 fig, 5 tab, 13 ref, 2 append.

Descriptors: Beaches, \*Seiches, \*Waves (Water), \*Coastal engineering, \*California, \*Nuclear explo-

Identifiers: \*Mono Lake (Calif), Wave tank experiments, Dispersive wave trains, Long period

An exploratory investigation was made in the laboratory wave tank to determine whether with existing equipment an oscillation (seiche) of the water over a submerged shelf just offshore could be induced by an incident train of shorter waves be induced by an incident train of shorter waves and if so, whether the run-up from the wave system on the beach would thereby be affected significantly. This study was a phase of current work dealing with the run-up and other shore effects of surface gravity waves from underwater explosions. When the wave-maker was set to generate short waves, a low-amplitude dispersive train preceded the regular (periodoc) train. Weak low-frequency oscillations in the run-up record occurring prior to the arrival of the periodic train were detected in seven of eighteen runs analyzed, the frequencies agreeing with estimates of firstwere detected in seven of eighteen runs analyzed, the frequencies agreeing with estimates of first-mode shelf-seiche frequencies. A special run-up factor was evaluated for four of seven runs; it indicated maximum run-up in the long-period wave spectrum along of from 35% to 85% of the maximum run-up in the spectrum of the incident dispersive waves. The highest value was associated with the highest incident train. From these results it was concluded that a eight existed. these results it was concluded that a seiche existed in some of the runs. It is believed that the principal reason why no oscillation was detected in other runs is that the heights of the incident dispersive waves (which could not be increased) were too small. When the wave-maker was set to generate long waves, the initial waves at the shelf were those of the periodic train. (Sinha-OEIS)

REFRACTION OF DISPERSIVE WAVES ON A Naval Civil Engineering Lab., Port Hueneme,

J. R. Evans, and D. G. True.

Available from the National Technical Informa-Stron Service as AD-618 876, \$3.00, in paper copy, \$1.45 in microfiche. NCEL Technical Note N-738, June 1965. 26 p, 15 fig, 2 tab, 2 ref.

Descriptors: \*Refraction (Water waves), \*Beaches, Coasts, \*Coastal structures, \*Nuclear Descriptors: explosions, Earthquakes, \*Tsunamis, Coastal en-gineering, \*Breakwaters, Piers.

Identifiers: \*Dispersive waves, Near shore processes, Refraction patterns, Underwater earthquakes, Water shock, Snell's Law, Green's

This study concerns measurements in the laboratory of refraction patterns of dispersive waves on a veach and the comparison of results with those predicted by theory. The object was to determine the effects of nuclear explosive excited surface water waves, air blast and water shock on piers, breakwater and other waterfront structures. Dispersive waves are also generated by earth movements under water which generate tsunamis. Beaches front many waterfront structures and hence affect wave loading on the structures. It was found that refraction of dispersive type waves on a beach may be predicted by use of Snell's Law, and amplitudes of refracted waves may be predicted by a modified form of Green's Law. (Sinha-OEIS) by a modifie W73-14628

EXPERIMENTAL STUDY OF LONGSHORE CURRENTS ON A PLANE BEACH,

C. J. Galvin Jr., and P. S. Eagleson. Available from the National Technical Information Service as AD-615 790, \$3.00 in paper copy, \$1.45 in microfiche. Technical Memorandum No. 10, January 1965. 88 p. 38 fig. 12 tab, 35 ref. 1 ap-

Descriptors: \*Beaches, \*Erosion, Deposition (Sediments), Sedimentation, \*Sediment transport,

\*Coasts, \*Waves (Water).
Identifiers: \*Near shore processes, \*Longshore currents, Surf zone, Wave effects.

Measurements were made of the characteristics of breaking waves and the resulting longshore currents for 34 combinations of wave height (up to 0.22 foot), period (0.90 to 1.50 seconds), and breaker angle (up to 32 degrees), along a 20-foot test section of a 30-foot plane, smooth concrete beach with a slope of 0.104. Observation and measurement show that most of the fluid in the surf zone stays there, and that longshore current velocity initially increases downstream from an obstacle. Velocity increases along the beach because the fluid forming the breaking wave has been withdrawn from the surf zone, and thus already has a longshore component of motion, to which is added the longshore component of motion of the breaking wave. A differential equation for this non-uniform flow agrees qualitatively with the measured variation of velocity with breaker angle and with distance from an obstacle. The nonuniformity of the flow was also indicated by the mean water level, which increased, and the breaker position and runup limit, which moved shoreward, downstream from the obstacle, but there is a possibility that these measurements were affected by the experimental apparatus. The energy used to maintain the flow of longshore currents is a small fraction (less than 1/10) of the energy brought to the surf zone by shoaling waves. The mean velocity of uniform longshore currents is approximately given by  $V\pm gmT$  sin20b, an equation which is one form of the conservation of mass in the surf zone. (Sinha-OEIS)

WATER WAVES FROM UNDERWATER EX-PLOSIONS IN SHALLOW WATER, PART II: CHARACTERISTICS OF WAVES NEAR THE SHORELINE AND METHOD OF ESTIMATING WAVE FORCES ON A VERTICAL BARRIER, Naval Civil Engineering Lab., Port Hueneme,

H. Wang. Available from the National Technical Information Service as AD-665 799, \$6.00 in paper copy, \$1.45 in microfiche. Report No. NCEL-TN-945-Pt-2, January 1968. 61 p, 35 fig, 10 ref, 1 append.

Descriptors: Ocean waves, Beaches, Shores, \*Sea walls, Seashores, Data processing, \*Barriers, \*Waves (Water), \*Nuclear explosions. Identifiers: \*Near shore processes, Incident wave shape, Water particle velocity, \*Wave profiles, Surface gravity waves, Beach slope.

The characteristics of dispersive water waveswave celerity, water particle velocity, and wave deformation—were studied in the laboratory in a region adjacent to the shoreline on a beach which has a 1:14 slope. The waves were generated by immersing a plunger at a distance from the shoreline in water of constant depth. A numerical scheme for the calculation of mean water particle velocity in the horizontal direction was developed according to the principle of continuity. This scheme is highly stable and is suitable for small computer facilities such as the IBM 1620. Methods for the estimation of wave forces and pressures on a vertical barrier, mounted as a seawall, were developed. The methods are based on momentum consid tion and require knowledge of the water particle velocity in the horizontal direction and the shape of the incident wave. (Sinha-OEIS) W73-14634

A CASE STUDY OF LITTORAL DRIFT BASED ON LONG-TERM PATTERNS OF EROSION AND DEPOSITION,

Johns Hopkins Univ., Baltimore, Md. Cheaspeake Bay Inst.

For primary bibliographic entry see Field 02L. W73-14641

MODELLING TECHNIQUES FOR A SYSTEM ENGINEERING APPROACH OF THE PROBLEMS OF WATER USES FOR AGRICUL-TURAL PURPOSES, Padua Univ. (Italy). Instituto di Elettrotecnica e di

Elettronica.

A. Lepschy, S. Milo, and D. Torriano. In: Systems Approaches to Developing Countries, Proceedings of Symposium, sponsored by International Federation of Automatic Control and the International Federation of Operational Research Societies, Algiers, Algeria, May 28-31, 1973, p 491-497, 1973. 6 fig.

Descriptors: \*Hydraulic engineering, \*Hydraulic systems, \*Mathematical models, \*Systems analysis, \*Simulation analysis, \*Design, Agriculture, Water users, Resource allocation, Canals, Net-works, Reclamation, Irrigation, Computers, \*Ir-

rigation. Identifiers: State variable approach, Hydraulic plants, Developing countries.

The problems of reclamation and irrigation plants are becoming increasingly important for a better exploitation of agricultural resources and for the improvement of land use. The main results hither-to obtained in the field of hydraulic system simulation are summarized and a possible exploitation of these methods for design purposes is presented. Techniques are suggested to derive mathematical models for studying the most important problems which arise in the design and control of hydraulic plants. A main characteristic of the models considered is the adoption of a state variable ap-proach, and the use of those techniques which refer to system theory and are suitable for the

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#### Group 8B-Hydraulics

computer approach to problems of system en-gineering concerning land use. A state variable model of canal networks for agricultural purposes is presented; this model may be set up by combining elementary block diagrams corresponding to the main kinds of subsystem into which the whole system may be subdivided. A model for a hydrausystem may be subdivided. A model for a hydraulic hoisting reclamation plant is discussed and the approach to the solution of a design problem is presented based on the comparison of the values of some performance indexes corresponding to different control policies. (Bell-Cornell) W73-14672

DISPLACEMENT MECHANICS IN PRIMARY CEMENTING.

Esso Production Research Co., Houston, Tex. For primary bibliographic entry see Field 08F. W73-14703

PRESSURE TRANSIENT ANALYSIS OF NATURALLY FRACTURED RESERVOIRS WITH UNIFORM FRACTURE DISTRIBUTION, Atlantic Richfield Co., Dallas, Tex.

H. Kazemi. Society of Petroleum Engineers Journal, Vol 9, No 4, p 451-462, December, 1969. 13 fig, 4 tab, 15 ref.

Descriptors: \*Fractures (Geologic), \*Oil reservoirs, \*Porosity, \*Porous media, Pressure, Drawdown, Fluid flow, Heterogeneity, Homogeneity, Unsteady flow, Mathematical models, Storage

Identifiers: \*Pressure transient analysis, Boundary effects, Skin effect, Warren-Root equations,

A number of papers are reviewed on the analysis of flow and buildup tests for obtaining reservoir characteristics. An ideal theoretical model of a naturally fractured reservoir with a uniform fracture distribution is presented. This model consists of a finite circular reservoir with a centrally located well and two distinct porous regions, referred to as matrix and fracture. The matrix has high storage but low flow capacity. The fracture has low storage, but high flow capacity. The flow in the entire reservoir is unsteady state. In general, the analysis of a naturally fractured reservoir from pressure transient data relies considerably on the degree and type of heterogeneity of the system. Testing procedures and facilities are sometimes as important. Nevertheless, under favorable condi-tions, calculations should be possible of in-situ characteristics of the matix-fracture system, such as pore-volume ratio, overall capacity of the formation, total storage capacity of the porous matrix, and some measure of matrix permeability. The behavior of a fractured reservoir approaches that of an equivalent system of hom reservoir at large times. (Gray-NWWA) W73-14708

EFFECT OF ANISOTROPY AND STRATIFICA-TION ON PRESSURE TRANSIENT ANALYSIS OF WELLS WITH RESTRICTED FLOW ENTRY,

Atlantic Richfield Co., Dallas, Tex. H. Kazemi, and M. S. Seth. Journal of Petroleum Technology, Vol. 21, No. 5, p 639-646, May, 1969, 9 fig, 15 ref.

Descriptors: \*Flow resistance, \*Anisotropy, \*Stratification, \*Pressure, Drawdown, Productivity, Flow, Subsurface flow, Mathematical models. Identifiers: \*Drill-stem tests, \*Boundary conditions, Buildup, Interference test, Pressure transient analysis transient analysis

A numerical model was devised with a more realistic boundary condition than in earlier studies. A chart is provided to include the effect of anisotropy in production impairment estimations. The results of the conventional interference test analysis, which are based on total penetration, can be applied to reservoirs, with restricted flow entry. Equations were derived to calculate the proper duration of flow and buildup tests. These equations can be used in analyzing short-term tests, such as drill-stem tests, and as a preliminary measure in tests designed to indicate permeability stratifica-tion. (Gray-NWWA) W73-14710

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS, Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 04B. W73-14714

BURST RESISTANCE OF PIPE CEMENTED INTO THE EARTH,
Gulf Research and Development Co., Pittsburgh,

For primary bibliographic entry see Field 08F. W73-14715

FACTORS THAT AFFECT WELL LIFE. Universal Oil Products, St. Paul, Minn. Johnson

R. L. Schreurs. Irrigation Age, Vol 4, No 9, p 12, 14-15, 18, April, 1970. 2 fig.

Descriptors: Wells, \*Water wells, Iron bacteria, Chemical reactions, Bactericides, Groundwater, \*Scaling, Corrosion, \*Aquifer characteristics. Identifiers: \*Well development, \*Acidizing, Well efficiency, Pumping tests, Incrustation.

The expected service life of a well might be judged The expected service life of a well might be judged in somewhat the same way as human life expectancy. This analogy between wells and humans can be carried further in that both are prevented from producing at the highest level of their capabilities by causes completely foreign to themselves. There is nothing that can be done to the well itself to overcome such difficulties, but it is important to be able to recognize these outside important to be able to recognize these outside causes so as not to waste time and money trying to solve them by treating the well. There are, how-ever, a number of things which can cause the well to perform below its capability. These are a result of damage to the well itself and can be corrected by proper treatment. The most important of these is the elogging (incrustation) of the well screen or slotted portion of the well casing. An in-depth discussion of the common forms of incrustati uscussion of the common forms of incrustation and appropriate treatments is presented and a hypothetical study is graphically depicted. Stressed is the point that an incrusted well is inefficient and costly. To insure long, trouble-free life, a well should be inspected regularly, precise records kept and proper treatment applied at the appropriate time. (Cambell-NWWA) W73-14723

SOME EFFECTS OF SIZE DISTRIBUTION ON PARTICLE BRIDGING IN LOST CIRCULA-TION AND FILTRATION TESTS,

Texas Univ. Austin. C. Gatlin, and C. E. Nemir. Journal of Petroleum Technology, Vol 13, No 6, p 575-578, June, 1961. 4 fig, 3 tab, 19 ref.

Descriptors: "Particle size, "Particle gradation, "Filtration, "Well filters, Gravels, "Granules, Bentonite, "Drilling fluids. Identifiers: "Particle bridging, Maximum packing density, Filter cake permeability, Spurt loss, Lost circulation, Nut shells, Furnas method.

Particle size distribution such as to provide max-imum density of beds of packed solids (according to the method of Furnas) was investigated in a laboratory study of loss of mud circulation and filter cake formation. Tests on the bridging and

sealing of a wedge-shaped slot showed that a max-imum density distribution of nut-shell particles was more effective than a randomly selected sam-ple of the commercial product. Samples of frac-tionated bentonite were used in mud filtration tests on paper and on sandstone cores. Size range of the bentonite particles was 0.05 to 40 microns. The pentionite particles was 0.03 to 40 micross. The spurt loss at the beginning of filtration was least with the maximum density distribution but the rate of filtration following the initial spurt was lowest in the mud with a preponderance of the small parti-cles (which could not be considered as inert). The suggestion is offered that the Furnas theory may have application in the selection of aggregate for gravel packs and other filtration conditions. (Gray-NWWA)

THE HORIZONTAL WELL AS A NEW METHOD OF RANGE WATER DEVELOP-

METHOD OF KANGE WATER DEVELOP-MENT, Agricultural Research Service, Tucson, Ariz. J. T. Welchert, and B. N. Freeman. Progressive Agriculture in Arizona, Vol 21, No 6, p 8-11, November-December, 1969. 6 fig, 1 tab.

Descriptors: "Wells, "Water wells, Aquifer characteristics, "Groundwater, "Water sources, "Aquifers, Seepage, Springs. Identifiers: "Horizontal wells, Trapped water, Controlled seepage area, Cased spring

Providing stock water where desired at a price that is reasonable has always been a problem for the stockman. Conventional systems such as dirt tanks, catchment basins, vertical wells and springs have been satisfactory in some cases but each has a characteristic limitation. With the introduction of horizontal wells the potential is to tap relatively small, trapped water supplies that go undeveloped in conventional vertical well drilling. These systems are closed, gravity powered, inexpensive, efficient, reliable, sanitary and maintenance-free. A point which is stressed is that 'horizontal wells' cannot be drilled just anywhere. Proper site selection, using reliable indicators, and the recognition of the two basic types of teanned waters, the dike horizontal wells the potential is to tap relatively of the two basic types of trapped waters, the dike and the contact source, are the keys to successful well development. Equipment, methods of development and system advantages are discussed (Smith-NWWA) W73-14729

A FIELD STREAMING-POTENTIAL EXPERI-

MENT, Schlumberger Well Surveying Corp., Ridgefield, For primary bibliographic entry see Field 08G. W73-14731

#### 8C. Hydraulic Machinery

PUYALLUP HATCHERY POND AND PUMPING PLANT CONSTRUCTION, Washington State Dept. of Fisheries, Olympia.

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For primary bibliographic entry see Field 081. W73-14357

RIVERSIDE'S GROUND WATER PUMPING

FMC Corp., Los Angeles, Calif. Peerless Pump For primary bibliographic entry see Field 04B. W73-14478

IMPLICATIONS OF PLLRC TAX RECOMMEN-DATIONS FOR FEDERAL HYDRO PROJECTS AND POWER FACILITIES,

Tennessee Valley Authority, Knoxville. Div. of Navigation Development and Regional Studies. For primary bibliographic entry see Field 06E. W73-14512

EVALUATION OF MULTIANNUAL FIRM HYDROELECTRIC POWER--A NEW METHOD, Hidrotecnica Portuguesa, Lisbon. Dept. of Civil bibliographic entry see Field 02A.

EFFECTIVENESS OF THE OPTIMIZATION OF THE INPLANT REGIMENS OF HYDROELEC-TRIC PLANTS, V. D. Urin.

v. D. Uria. Hydrotechnical Construction, ASCE, No 10, p 976-979, October 1972. 1 fig, 2 tab, 6 ref. (Translated from Gidrotekhaicheskoe Stroitel'stvo, No. 10, p 37-39, October 1972).

Descriptors: "Hydroelectric plants, "Regimen, "Optimization, Dynamic programming, Economic efficiency, Evaluation, Load distribution, Flow, Benefits, Hydraulic structures, Hydraulic turbines, Conduits, Mathematical models, Systems analysis, Equations analysis, Equations. \*Effectiveness, Operating charac-

Optimization of a hydroelectric plant regimen for a given load calls for the solution of three mutually related problems of selecting the optimum: (a) number of operating units-obtainable from the average characteristics of the units, aided by simple automation; (b) composition of the operating units-effectiveness depends upon number of operating units and number installed; and (c) load distribution among the units. Evaluation is made of the effectiveness of each of the three optimization elements, utilizing the experience obtained from many analyses made at the electric shop of ORGRES Trust from 1966-1969. Flow and relative growth characteristics have been constructed for growth characteristics have been constructed for 20 hydroelectric plants in Transcaucasia, with use made of data from full-scale investigations for 19 of these plants. The inplant regimen was optimized by the method of combined characteristics, which by the method of combined characteristics, which is a graphical analogue of dynamic programming. To control the analyses, the energy characteristics of one of the plants was obtained also by dynamic programming. It is concluded that optimization of the inplant regimens for hydroelectric plants yields substantial advantages and its introduction is necessary in order to increase the technical-economic indices of the plants. (Bell-Cornell) W73-14668

HYDRAULIC JETTING-SOME THEORETICAL AND EXPERIMENTAL RESULTS, Gulf Research and Development Co., Pittsburgh,

For primary bibliographic entry see Field 08G.

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### 8D. Soil Mechanics

SELECTED BIBLIOGRAPHY ON LABORATORY AND FIELD METHODS IN GROUND WATER HYDROLOGY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W73-14711

PHYSICAL AND THERMAL PROPERTIES OF PROZEN SOIL AND INEMAL PROFILES OF FROZEN SOIL AND ICE, Continental Oil Co., Ponca City, Okla. L. H. Wolfe, and J. O. Thieme. Society of Petroleum Engineers Journal, Vol 4, No 1, p 67-72, March, 1964. 14 fig, 5 ref.

Descriptors: \*Frozen soils, \*Ice, Permafrost, \*Tensile strength, \*Shear strength, \*Compressive strength, Thermal conductivity, Specific heat, Thermal properties, Clay, Silt, Soil moisture, Underground storage, Cryogenics, Soil physical properties. Identifiers: Thermal diffusivity, Liquified gas

Underground storage of cryogenic liquids, such as liquid natural gas, requires prior knowledge of the strength and thermal characteristics of the soil. Methods are described for the measurement of tensile, compressive and shear strengths, specific heats and thermal conductivities of soils. These properties were measured on a clay and a silt, at moisture contents of 17% and 22%, at tempera-tures from ambient to -195C. Thermal diffusivity values for silt, clay and ice were calculated. Dif-fusivity increased with the moisture content. Lowering the temperature increased the strength of the soils. Thermal properties of frozen soils are more dependent on moisture content than on tem-perature. (Gray-NWWA) W73-14717

THE EFFECT OF STRESS ON PERMEABILITY OF SANDSTONE CORES,

California Univ., Berkely. I. Fatt.

Society of Petroleum Engineers Journal, Vol 3, No 2, p 95-100, June, 1963. 11 fig, 14 ref.

Descriptors: \*Permeability, Permeameters, Flow, Rock properties, \*Sandstone, \*Stress, Pressure, Earth pressure.

Identifiers: Boise (Idaho), Berea (Ohio), Grubb (California), Permeability anisotropy, Permeability reduction, Nonuniform stress, Radial stress,

Studies are reported on the permeability anisotropy and the permeability under nonuniform stress of cores of Boise, Berea, and Grubb sandstones. Permeability anisotropy was a function of overburden pressure. Increase in applied stress from 0 to 5000 psig caused a significantly greater reduction in vertical permeability than in horizontal. Boise and Berea sandstones showed increasing isotropy at higher applied stress. Permeability reduction under nonuniform stress was less than that under uniform stress. Grubb sandstone was very sensitive to overburden pressure. Permeability reduction of the Berea and Grubb sandstone cores subjected to simulated overburden pressure was a function of the ratio of the radial to axial stress. (Gray-NWWA) W73-14718

THE ALTERATION OF ROCK PROPERTIES Shell Oil Co., Ventura, Calif. For primary bibliographic entry see Field 08E. W73-14730 BY PERCUSSION SIDEWALL CORING,

#### 8E. Rock Mechanics and Geology

OPTIMIZATION OF WATER RESOURCE SYSTEMS INCORPORATING EARTHQUAKE RISK: 1973 CONTRIBUTIONS, California Univ., Los Angeles. Dept. of Engineering Systems. For primary bibliographic entry see Field 06A. W73-14204

STRENGTHENING ROCK BY INJECTION OF CHEMICAL GROUT, Corps of Engineers, Omaha, Nebr. Missouri River For primary bibliographic entry see Field 08G. W73-14704

A LIQUID FREON PERMEAMETER, Socony Mobil Oil Co. Inc., Dallas Tex. For primary bibliographic entry see Field 08F. W73-14706

TEMPERATURE PROSPECTING FOR SHALLOW GLACIAL AND ALLUVIAL AQUIFERS IN ILLINOIS, Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 04B. W73-14714

THE EFFECT OF STRESS ON PERMEABILITY OF SANDSTONE CORES, California Univ., Berkely. For primary bibliographic entry see Field 08D. W73-14718

EXPERIMENTAL TESTS OF A METHOD FOR DRILLING WITH EXPLOSIVES, Esso Production Research Co., Houston, Tex. For primary bibliographic entry see Field 08H. W73-14719

THE BOREHOLE TELEVIEWER-A NEW LOGGING CONCEPT FOR FRACTURE LOCATION AND OTHER TYPES OF BOREHOLE IN-SPECTION.

Mobil Research and Development Corp., Dallas, For primary bibliographic entry see Field 08G.

W73-14721

EFFECT OF OVERBURDEN PRESSURE ON SOME PROPERTIES OF SANDSTONES, California Univ., Berkeley. V. M. Dobrynin. Society of Petroleum Engineers Journal, Vol 2, No 4, p 360-366, December, 1962. 12 fig. 14 ref.

Descriptors: \*Overburden, \*Pressure, Physical properties, \*Porous media, \*Compressibility, Density, Resistivity, Permeability, Seismic waves, Poisons, Ratio, Mathematical studies, \*Sandstones, Pressure. Identifiers: Longitudinal waves.

Experimental data show that physical properties of porous rocks change under pressure. Two sandstones were examined in the overburden pressure stones were examined in the overburden pressure range from 0 to 20,000 psi while the internal pore pressure was atmospheric in one series and 1800 psi in another. Physical properties measured were compressibility, density, resistivity, permeability, and velocity of longitudinal waves. Changes in physical properties are determined to a large expnysical properties are determined to a large ex-tent by the pore compressibility. Pore compressi-bility can be calculated (in the pressure range in-vestigated) by knowing the maximum pore com-pressibility andthe magnitude of the pressure. Mathematical equations were developed that describe the effect of pressure on significant physical properties of sandstones. These relation-ships are shown graphically. (Gray-NWWA) W73-14724

ROCK STRESSES INDUCED BY FLOW OF FLUIDS INTO BOREHOLES, Rice Univ., Houston, Tex. P. R. Paslay, and J. B. Cheatham, Jr. Society of Petroleum Engineers Journal, Vol 3, No 1, p85-94, March, 1963. 9 fig, 5 ref.

Descriptors: \*Rock properties, \*Shear strength, \*Stress, Strength, Boreholes, Flow, Saturated flow, Permeability. Identifiers: \*Borehole stability, \*Permeability reduction, Displacement distribution, Water shu-

In many cases, an increased production rate effected by substantially increasing the pressure gradient through the formation adjacent to the borehole causes excessive sand production, wear of production equipment and necessitates rework-ing the well. A mathematical analysis was made of the steady state flow rates, stresses and displace-

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ments developed in the vicinity of the borehole by applied surface loads and flow of liquids from a rock formation saturated with an incompressible fluid. To prevent rock failure, the rock shear strength must be approximately two-thirds the for-mation fluid pressure. Fermeable rocks sometimes become partially plugged during normal comple-tion and production of a well. The analysis showed that if a region of permeability reduction of 1000:1 extends to a radial thickness of 1 per cent of the borehole diameter, the rock must be about 80 perborenoie diameter, the rock must be about 80 per-cent stronger than for the unplugged state. No ad-ditional rock strength is required for a stable borehole if plugging extends beyond 15 percent of the hole diameter, although a further decrease of production rate is obtained. If gradual plugging oc-curs during production of a well, the borehole wall will fail when the plugged region extends to a thickness at which the required rock strength ex-ceeds the actual rock strength. (Gray-NWWA) W73-14725

CORRELATIONS OF PHYSICAL PROPERTIES OF POROUS MEDIA,

Texas A and M Univ., College Station. W. D. Von Gonten, and R. L. Whiting. Society of Petroleum Engineers Journal, Vol 7, No 3, p 266-272, September, 1967. 2 tab, 7 ref.

Descriptors: \*Physical properties, Correlation analysis, \*Regression analysis, \*Porosity, \*Permeability, Density, \*Porous media, Sandstone, Limestone, Young's modulus, Poisson's ratio

Identifiers: Formation factor, Shaliness factor, Shear modulus, Capillary pressure curve, Pore radius, Displacement pressure.

Physical properties were measured on 568 oil well cores from the Illinois Basin, Rock Mountain area, Colifornia, Louisiana and Texas; 478 were sand-stone; 90 limestone. Properties obtained on all samples were porosity, grain density, air permea-bility, formation factor, shaliness factor, mercuryinjection capillary pressure curve, midpoint pore radius, average pore radius, equation of capillary pressure curve, and displacement pressure. On 123 sandstone and 61 limestone samples, sonic velocities of the compressional and shear waves were measured and Poisson's ratio, Young's modulus, shear modulus, bulk modulus and sonic velocity were calculated. A regression analysis progra was used on a computer to evaluate the coefficients of the equations and to determine which in-dependent variables were significant in each equation. Seven equations are presented for predicting porosity, formation factor and permeability. These equations should be useful in contributing to the understanding of the relationship between the physical properties of porous media. (Gray-NWWA) W73-14728

THE ALTERATION OF ROCK PROPERTIES BY PERCUSSION SIDEWALL CORING,

ll Oil Co., Ventura, Calif. G. M. Webster, and G. E. Dawsongrove. Petroleum Transactions, AIME, Vol 11, No 4, p 385-388, April, 1959. 12 fig, 1 tab, 1 ref.

Descriptors: \*Cores, \*Porosity, \*Permeability, \*Rock properties, \*Sandstones, Laboratory tests, Capillary action, Physical properties, Porous

Identifiers: Sidewall cores, Conventional cores, Diamond cores, Oil content, Water content, Percussion coring, Thin sections, Photomicrographs.

Percussion sidewall cores from nine oil-productive sandstone zones were compared with conventional cores from the same zones. Photomicrographs of thin sections from sands recovered by parpus of this sections from sands recovered by percussion sidewall coring indicated some shatter-ing and readjustment of the grains. Disturbance was more pronounced in harder, less porous

sands. Porosities of sidewall samples were significantly higher for the less porous sands than for samples from conventional cores. Little difference samples from conventional cores. Little difference was noted when the porosity of the conventional core sample was 20% or greater. Limited data indicates that permeabilities of percussion core samples are lower than those of conventional samples, except in the low permeability range, in which case, the reverse may be found. Mercury capillary pressure determinations indicate that the effective pore size and pore size distribution have been appore size and pore size distribution nave ocen ap-preciably altered in the percussion cores. Somewhat higher water contents and lower oil contents in the sidewall cores can be attributed to invasion of mud filtrate. (Gray-NWWA)

A STUDY OF FORMATION PLUGGING WITH BACTERIA, Alberta Univ., Edmonton.

J. T. Raleigh, and D. L. Flock Journal of Petroleum Technology, Vol 17, No 2, p 201-206, February, 1965. 12 fig, 1 tab, 13 ref.

Descriptors: \*Bacteria, \*Injection, \*Flooding, \*Sands, \*Limestones, Brines, Porous media, Capillary action, Pores, Rock properties. Identifiers: \*Bacillus subtilis, Capillary pressure curves, Pore-geometry factor, Thomeer, Displacement pressure, \*Formation plugging.

The injection of water into formations may be decreased, or the pressure increased, in consequence of plugging of the porous rock by bac-teria in the injected water. In a laboratory study, the injection rate and concentration of bacteria held constant in tests on two sandstones and two limestones. Bacillus subtilis (dead) was suspended in 2.5% sodium chloride solution. The ore geometry factor (Thomeer) was calculated pore geometry factor (induct) room measurements of properties of the 15 cores examined. The pore geometry factor is a measure of the sorting and interconnection of the pore sizes. Results showed that the factor was a significant the factor was a significant that the factor was a s cant rock characteristic for correlation with depth of plugging but failed as an indicator of rate of plugging. Neither permeability nor irreducible water saturation correlated with rate of plugging. The pore geometry factor might have application in establishing injection water specifications in more homogeneous rocks having only primary porosity development. (Gray-NWWA) W73-14732

#### 8F. Concrete

CANAL BANK RETAINING WALL MEANS AND METHOD, For primary bibliographic entry see Field 08A. W73-14698

DISPLACEMENT MECHANICS IN PRIMARY

CEMENTING, Esso Production Research Co., Houston, Tex Basso Froduction Research Co., 1100 May W. Whitaker. Journal of Petroleum Technology, Vol 19, No 2, p 251-260, February 1967. 19 fig, 2 tab, 16 ref.

Descriptors: \*Cements, \*Slurries, \*Mud, \*Casings, Flow, Laminar flow, Turbulent flow, \*Non-Newtonian flow, Gels, Yields strength, Reynolds number.

Identifiers: Flow patterns, \*Slurry displacement, Eccentric annulus, Mobility ratio, Bingham

Successful primary cementing of casing leaves no continuous channels of mud capable of flow dur-ing subsequent production. A study of the mechanics of mud displacement by cement slurry was made by means of analytical models and dis placement experiments. Tendency of the cement to bypass mud is a function of the geometry of the

annulus, the density and flow properties of the mud and the cement slurry, and the rate of flow. Bypassing can be prevented if the pressure gradient produced from circulation of the cement and by buoyant forces exceeds the pressure gradient necessary to drive the mud through the narrowest side of the annulus at the same velocity as the cement. Unless the cement slurry has greater density than the mud, the requirement to balance the pressures is to maintain the Bingham yield strength of the cement greater than the yield of the mud multiplied by the maximum distance from the casing to the wall of the borehole and di-vided by the minimum distance. Thinning a cement slurry can increase turbulent flow in an eccentric annulus but will reduce the efficiency of displacement. Rotation of the casing served to remove the channel of gelled mud that formed between the pipe and the nearby wall in very eccentric annuli. (Gray-NWWA)

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RHEOLOGICAL DESIGN OF CEMENTING

OPERATIONS, Halliburton Services, Duncan, Okla. K. A. Slagh

Journal of Petroleum Technology, Vol 14, No 3, p 323-328, March, 1962. 2 fig, 2 tab, 10 ref.

Descriptors: \*Cements, \*Slurries, Hydraulics, \*Viscosity, \*Turbulent flow, Laminar flow, Reynolds number, Pozzolans, Bentonite, Reynolds number, Pozzolans, Bentonite, Diatomaceous earth, Non-Newtonian flow, Cas-

Identifiers: API Class A cement, Thixotropy, Fanning friction factor, Rotational viscometer, API RP10B, Hydraulic radius.

Laboratory measurements were made of flow properties of API class A cement slurries and of slurries containing the common cement additives. A multi-speed rotational viscometer was used. From a logarithmic plot of shear rate vs. shear stress, the flow-behavior index and the consistency index were determined. Average values of these factors and of the densities of the slurries are tabulated for samples of cement (API Class A) from seventeen sources. Examples are shown of the application of these properties in field operations to calculate flow rates, pressure drops, and critical velocities to approach turbulent flow in the casing-borehole is for several hole diameters. (Gray-NWWA)

A LIQUID FREON PERMEAMETER,

Socony Mobil Oil Co. Inc., Dallas Tex. B. G. Hurd.

Laboratory equipment.

Society of Petroleum Engineers Journal, Vol 2, No 1, p 18-20, March, 1962. 2 fig.

Descriptors: \*Permeability, \*Permeameters, Rock properties, \*Instrumentation, Darch's law, Flow, Porous media, Nitrogen.
Identifiers: \*Freon, Dichlorodifluoromethane,

The design of a liquid-Freon permeameter is shown schematically. It can be assembled from stock items of laboratory equipment. The method of use is described. The liquid-Freon permeameter retains the inherent accuracy of the liquid per-meameter while affording the speed and ease of operation of the gas permeameter. Replicate measurements and comparison of results with those with conventional liquid and gas permeameters showed adequate precision up to 1000 md. The liquid-Free permeaneter is not recommended for permeabilities higher than 1000 md. (Gray-NWWA) W73-14706

FAILURES IN THE BOTTOM JOINTS OF SURFACE AND INTERMEDIATE CASING FACE AND INTERMEDIAT STRINGS, Atlantic Richfield Co., Dallas, Tex. For primary bibliographic entry see Field 08G. W73-14712

BURST RESISTANCE OF PIPE CEMENTED INTO THE EARTH, Gulf Research and Development Co., Pittsburgh,

Pa. R. E. Zinkham, and R. J. Goodwin. Journal of Petroleum Technology, Vol 14, No 9, p 1033-1040, September, 1962. 9 fig, 1 tab, 20 ref.

Descriptors: \*Cements, \*Well casings, \*Tensile Descriptors: "Cements, "Well casings, "Tensile strength, "Compressive strength, Shear, Stress, Design data, Steel pipes, Casings, Strength of materials, Youngs modulus, Mathematical study, Identifiers: "Burst resistance, "Casing design, Ce-ment sheath, Mud filter cake, Hydraulic fracture.

A modification in casing design practices is proposed that could either reduce the amount and grade of steel required to contain a specified inter-nal pressure, or allow the working pressure to be increased for a specified weight and grade of pipe. A mathematical study was made of the increased urst resistance a cement sheath would provide. Limiting assumptions were: (1) the pipe is completely surrounded by cement, and (2) any mud filter cake between the cement and the earth has the same physical properties as either the ce-ment or the earth. Calculations showed that a cement sheath provides little or no support to the casing when the cement is unconfined or effectively stressed only in tension. When the cement is y suessed only in tension. When the cement is confined between the pipe and the earth and is loaded in compression, the pipe could receive a substantial amount of support. Data are shown in six charts. The potential usefulness of the cement sheath may be further increased by such downhole sheath may be further increased by such bowning conditions as increased pressure, temperature, and confinement. The higher the modulus of elasticity for the cement sheath and the surrounding earth, the greater the amount of support they will give the pipe. (Gray-NWWA)

#### 8G. Materials

REACTIONS AND TRANSPORT PHENOMENA AT SURFACES, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 03A. W73-14381

STRENGTHENING ROCK BY INJECTION OF CHEMICAL GROUT, Corps of Engineers, Omaha, Nebr. Missouri River

Div H. B. Erickson.

Diurnal of the Soil Mechanics and Foundations Division, American Society of Civil Engineers, Vol 94, No SM1, p 159-173, January 1968. 4 fig, 2 tab, 5 ref.

Descriptors: "Grouting, "Rock mechanics, Materials, Rock properties, Underground structures, "Stress, "Shear, "Resins, "Chemical grouting. Identifiers: Epoxy resin grout, Polyester resin grout, Shear planes, Joints, Stress relief.

After any excavation of cohesive rock, the rock around the new opening contains the original fracaround the new opening contains the original trac-tures - joints, sheer planes and fractures - plus ad-ditional fractures caused by the stress relief in-herent in the excavation process. If the openings are not immediately strengthened by some means, individual blocks of rock can rotate out of their original position and weaken the formation through the development of new fracture systems. This may possibly close off the excavation. If, however, the openings are filled with a chemical grout of the proper strength formation stability can be improved. Factors are presented which determine the feasibility of chemical grouting in field situations. Descriptions of equipment, types of grout and methods used for emplacement, and a field case study are also presented. (Smith-NWWA) W73-14704

RHEOLOGICAL DESIGN OF CEMENTING

OPERATIONS, Halliburton Services, Duncan, Okla. For primary bibliographic entry see Field 08F.

FAILURES IN THE BOTTOM JOINTS OF SUR-FACE AND INTERMEDIATE CASING STRINGS,

Atlantic Richfield Co., Dallas, Tex. F. J. Schuh.

Journal of Petroleum Technology, Vol 20, No 1, p 93-101, January, 1968. 4 fig, 4 tab, 6 ref.

Descriptors: Casings, \*Cement, Pipes, Wells, Rotary drilling, \*Welded joints, Joints (Connections), Momentum transfer, Strength of materials, \*Well

casings.

Identifiers: \*Casing failure, \*Torque, Cementing plugs, Cementing equipment, Rotary speed, Drill collars, Thread-locking compounds, Pipe threads.

Failure in the bottom joints of casing can require expensive remedial action. Various possible causes of failure were examined. Failures are causes of failure were examined. Failures are caused by high energy torque impulses delivered from the drill string while drilling the cementing plugs, cement, and float equipment from the bot-tom joints of the casing string. The magnitude of the torque impulse is a function of the drill string relational momentum. Greaths above the minimum rotational momentum. Graphs show the minimum rotational momentum. Graphs show the minimum rotary speed and collar size required to unscrew casing without and with thread-locked couplings. Recommendations to eliminate failure are: (1) cement all casing strings with two plugs; (2) strengthen the three lowermost couplings joining the bottom four joints (six couplings on seven joints if a bottom plug cannot be used); (3) on 1-55 or stronger casing and on all float equipment, clean all threads to be strengthened with suitable solvent before applying thread-locking com-pounds; (4) on H40 grade, strengthen the connec-tions with a 1/4-inch fillet weld, and (5) limit rotary speed while drilling out cement to a safety facto of two between the torsional strength of the thread-locked joints and the maximum torque impulses of the bottom collars. (Gray-NWWA) W73-14712

CATHODIC PROTECTION WORKS, Harco Corp., Cleveland, Ohio. H. W. Hosford.

strial Water Engineering, Vol 7, No 3, p. 33-34. March, 1970. 3 fig.

Descriptors: \*Corrosion control, \*Cathodic protection, Cathodes, Equipment, \*Coatings, Metal pipes, Engineering structures, Resistivity. Identifiers: \*Stray current corrosion, \*Galvanic pipes, Engineering structure, records of Galvanic Identifiers: \*Stray current corrosion, \*Galvanic corrosion, Coal-tar enamel coatings, Sacrificial anodes, Electrical bonding.

Cathodic protection is an electrical method of preventing corrosion. It works by making the metal surface to be protected a cathode of an elec-trochemical cell. By implication, cathodic protection principals can be used to prevent the corro-sion of any metal. This is accomplished by direct-ing an artificial, external current from a sacrificial ing an artificial, external current from a sacrificial anode to the cathodic pipe, which makes it impossible for the cathodic pipe itself to corrode. A discussion is presented of the basic types of corrosion and their causes, and the principals of cathodic protection in different corrosive environments with a very basic cost analysis. (Campbell-NWWA) W73-14713

THE BOREHOLE TELEVIEWER-A NEW LOGGING CONCEPT FOR FRACTURE LOCATION AND OTHER TYPES OF BOREHOLE IN-

Mobil Research and Development Corp., Dallas,

J. Zemanex, R. L. Caldwell, E. E. Glenn, Jr., S. V. Holcomb, and L. J. Norton.

Journal of Petroleum Technology, Vol 21, No 6, p 762-774, June, 1969. 15 fig, 14 ref

Descriptors: "Well logging, "Subsurface investiga-tions, "Acoustics, "Well casings, "Fractures (Geologic), Electrical well logging, Rock proper-ties, Faults (Geologic), Fissures (Geologic), Porosity, Limestone, Borehole cameras. Identifiers: Fracture orientation, "Borehole televi-sion, Acoustic picture, Transducer, Magnetome-ter, Vugs, Permian formation, Indiced fracture, Casing inspection.

The Borehole Televiewer (BHTV) produces an acoustic picture in the form of a well log. The log, which is run continuously, can define both induced and natural fractures, and can show vuggy porosity, the size and distribution of perforations in casing, and casing failures. The basic method is as follows. A piezoelectric transducer probes the borehole wall with bursts of acoustic energy.

Orientation of the log is provided from the earth's magnetic field by a flux-gate magnetometer. A motor rotates the transducer and magnetometer within the tool at about 3 revolutions per secon Appropriate electronic circuits process signals from the transducer and magnetometer for use at the surface. The borehole can be filled with any homogeneous gas-free liquid. The resulting log presents the borehole wall as if it were split vertically and laid flat. Any physical changes in the borehole wall appear as changes in picture intensity. Photographs and diagrams illustrate the operation of the device. Although the instrument is regarded as of greatest utility in the quantitative evaluation of natural and induced fractures, where no other logging device is as effective; application to inspection of casing, location of vugs and washouts, identification of lithology, and deter-mination of dip may be equally as significant. (Gray-NWWA) W73-14721

FACTORS THAT AFFECT WELL LIFE, Universal Oil Products, St. Paul, Minn. Johnson For primary bibliographic entry see Field 08B. W73-14723

SOME EFFECTS OF SIZE DISTRIBUTION ON PARTICLE BRIDGING IN LOST CIRCULA-TION AND FILTRATION TESTS, Texas Univ., Austin. For primary bibliographic entry see Field 08B. W73-14726

A FIELD STREAMING-POTENTIAL EXPERI-

MENT, Schlumberger Well Surveying Corp., Ridgefield,

Conn.
M. Gondouin, H. J. Hill, and M. H. Waxman.
Journal of Petroleum Technology, Vol 14, No 3, p
305-312, March, 1962. 14 fig, 3 tab, 9 ref.

Descriptors: \*Electric well logging, \*Resistivity, \*Drilling fluids, Logging (Recording), Subsurface investigations, Porous media, Shales, Sands, Pressure measuring instruments, Hydrostatic pressure. Identifiers: "Streaming potential, Spontaneous potential, Induction log, Mud cake, Electrochemical potential.

#### Field 08-ENGINEERING WORKS

## Group 8G-Materials

Measurements were made in the borehole of the streaming-potential behavior of shales and mud cakes within the Muddy-and Dakota-sandstone interval of a Denver basin well. Pressure in these water-bearing sands is low (gradient 0.25 psi per foot) and they are separated by a shale interval of about 150 ft. A series of experiments was made in which the resistivity of the mud filtrate, the pressure in the borehole, and the logging equipment were varied. Streaming potentials opposite shales were of sufficient magnitude to be important in spontaneous potential interpretation. The shale streaming potentials were linearly dependent on the pressure differential and they increased with mud filtrate resistivity. Streaming potentials opposite sands were higher than those opposite shales when the mud was made with fresh water. The characteristics of the mud used in drilling the sand sections influenced the magnitude of the streaming potential at the time of logging, even though the mud used in drilling that be suitable for determining streaming potential corrections. Following a change in mud characteristics, several days were required for the spontaneous potential to stabilize. This effect was due in part to the mud cake acting as an imperfect shale membrane. (Gray-NWWA)

HYDRAULIC JETTING--SOME THEORETICAL AND EXPERIMENTAL RESULTS, Gulf Research and Development Co., Pittsburgh,

Pa.

J. L. Pekarek, D. K. Lowe, and J. L. Huitt.
Society of Petroleum Engineers Journal, Vol 3, No
2, p 101-112, June, 1963. 16 fig, 10 ref.

Descriptors: \*Well casing, \*Jets, Sand, Sandstone nozzles, Abrasive blasting.
Identifiers: Berea, \*Hydraulic jetting, Well cleanout, \*Jet perforating, Notch cutting, Casing perforation, Casing cutting.

The use of a fluid containing an abrasive material has been an established technique for cleaning and cutting in well casings for many years. The use of hydraulic jetting in well completion has become an accepted practice. A theoretical analysis of the mechanism of hydraulic jetting showed that the abrasive material exits from the jet nozzle at a lower velocity than the fluid. The exit particle velocity can be increased by increasing either the density of the fluid or the length of the nozzle and/or decreasing either particle density or particle diameter. There is a point in the divergent jet stream after which the particle velocity exceeds that of the fluid. An equation was derived to predict cutting rate of a circumferential notch and maximum notch depth. The theoretical predictions were substantiated by experimental results, using sand in water as the abrasive material. In addition, some studies were made of the effects of back pressure in the annulus; the distance between the nozzle exit and the casing; the rotational speed of the tool, and the concentration of the abrasive particles. (Campbell-NWWA)

#### 8H. Rapid Excavation

LABORATORY STUDY OF SEICHING IN-DUCED ON AN OFFSHORE SHELF, Naval Civil Engineering Lab., Port Hueneme, Calif. For primary bibliographic entry see Field 08B. W73-14627

REFRACTION OF DISPERSIVE WAVES ON A BEACH, Naval Civil Engineering Lab., Port Hueneme, Calif. For primary bibliographic entry see Field 08B. W73-14628 EXPERIMENTAL TESTS OF A METHOD FOR DRILLING WITH EXPLOSIVES,

Esso Production Research Co., Houston, Tex. L. H. Robinson. Society of Petroleum Engineers Journal, Vol 5 No 2, p 153-159, June, 1965. 10 fig, 3 ref.

Descriptors: \*Rotary drilling, \*Explosives, \*Drilling equipment, \*Rock excavation, Craters, Drilling, Sandstones, Metamorphic rocks, Limestones.

Identifiers: \*Shaped charges, Primacord, Detonator, Shock waves, Pentolite, Fracturing.

A proposed method of drilling utilizes sequential detonation of two types of explosive charges delivered to the hole by a conventional drilling fluid through pipe. A shaped charge first produces a long thin hole. A second charge, called a gauging charge, is pumped into the thin hole. The charge explodes and enlarges the hole to gauge. The proposed method was experimentally tested at the surface on 2-ft. cubes of Berea sandstone and on low-porosity (0.4%) metamorphic limestone. The test equipment is shown in diagrams and the results are illustrated by photographs. The proposed technique indicated a charge-to-rock removal ratio that would make the process feasible for drilling wells. A possible drilling sequence with modified rotary equipment is outlined. (Gray-NWWA)

## 81. Fisheries Engineering

PARAMETRIC DETERMINATION OF MINIMUM STREAM FLOW FOR TROUT, Wyoming Univ., Laramie. Water Resources Research Inst.

T. A. Wesche.

Available from the National Technical Information Service as PB-223 377, \$4.25 in paper copy, \$1.45 in microfiche. Water Resources Series No. 27, June 1973. 102 p, 40 fig, 6 tab, 27 ref. OWRR B-007-WYO (3).

Descriptors: "Trout, "Wyoming, Average flow, "Parametric hydrology, Brown trout, Aquatic habitats. Identifiers: "North Platte River basin (Wyo), "Average daily flow, Trout cover.

The approach taken in the determination of a suitable minimum flow to be maintained in a stream channel for the preservation of trout populations has centered on three types of physical stream characteristics and the changes observed in them between various discharge levels, based on the average dialy flow (ADF) over the period of record: hydrologic parameters; surface areas and its composition, based on water depth and velocity; and available trout cover. Portions of Douglas Creek and Hog Park Creek, relatively 30 cubic feet per second) located in the North Platte River drainage of southeastern Wyoming, were intensively investigated in the summer and fall of 1972 at 200%, 100%, 50%, 25%, and 12.5% ADF. Water depth, velocity, cross-sectional area, wetted perimeter, hydraulic radius, top width, total surface area, surface area for period or greater, and available brown trout cover decrease at the greatest rate for the discharge reduction interval from 25% to 12.5% ADF. As a minimum flow, a discharge in the 25% ADF range will avoid the flow range for which the rate of habitat decrease is greatest.

HYBRIDIZATION IN THE ACIPENSERIDAE FAMILY AND PERSPECTIVE USE OF IT IN STURGEON FARMING, (IN RUSSIAN), N. I. Nikolyukin.

N. I. Nikolyukin. Tr Vses Nauchno-Issled Inst Morsk Rybn Khoz Okeanogr. 76 p 56-69. 1970. (English Summary. Identifiers: \*Acipenseridae family, \*Hybridization, \*Sturgeon farming.

The most interesting sturgeon hybrid is great sturgeon X sterlet. The first and the second generation from repeated crossing with the female great sturgeon is recommended for commercial production. The repeat hybrid differs from F1 by its faster growth with greater variability, which widens possibilities for slection. Fertility of the great sturgeon X sterlet opens possibilities for new forms with hereditary stability for both the pond and diadromous species. —Copyright 1972, Biological Abstracts, Inc. W73-14280

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PUYALLUP HATCHERY POND AND PUMPING PLANT CONSTRUCTION,

Washington State Dept. of Fisheries, Olympia.

Available from NTIS, Springfield, Va 22151 as COM-72-11331 Price \$3.00 printed copy; \$1.45 microfiche. Contract Completion Report to NOAA, National Marine Fisheries Service, May 1972. 10 p, append.

Descriptors: \*Fish hatcheries, \*Fish reproduction, \*Engineering structures, \*Salmon, \*Washington, Ponds, Concrete construction, Asphalt, Fish migration, Costs, Fisheries. Identifiers: \*Orting (Wash), \*Puyallup Salmon Hatchery (Wash).

A construction program is described for the Puyallup Salmon Hatchery located on Voights Creek
about 1.5 miles east of Orting, Washington. This
project consisted of three jobs: (1) construction of
four concrete ponds in accordance with Engineerapproved plans and specifications; (2) construction of two 1/4-acre ponds and related supply and
drain lines in accordance with Engineer-approved
plans and specifications; and (3) an existing rack
and a fishway, pumping unit were reconstructed
and supply lines were connected. The total cost of
this project was \$160,789.58 shared equally by the
State and by the Federal Government. The additional ponds and water supply should increase
production of the Puyallup Hatchery by 57,000
pounds of salmon. (Woodard-USGS)
W73-14357

ELK RIVER SALMON HATCHERY EXPANSION.

Oregon Fish Commission, Portland.

E. K. Neubauer. Available from the National Technical Information Service as COM-72 11071. National Marine Fisheries Service, Completion Report Project No AFC-59, March 1972. 4 p. NMFS project AFC-59, Contract 14-17-0001-2338.

Descriptors: \*Construction costs, \*Salmon, \*Fish hatcheries, Design, \*Oregon.
Identifiers: \*Elk River (Ore.), Hatchery expansion

A final summary of the expansion of the Elk River Salmon Hatchery's rearing capacity from 1 million to 1.7 million smolts is presented. The estimated project cost of \$228,000 was equally shared by the Oregon Fish Commission and the National Marine Fisheries Service. The Commission's Division of Engineering was responsible for design and contract document preparation. Because initial bids received on July 31, 1970 exceeded the available funds, the design was altered and new bids were called. The contract was awarded to Richard L. Mertin, Inc. on March 29, 1971 for the low bid of \$186,708. Construction began April 5 and proceeded according to contract requirements with no unusual delays or other problems. Three Change Orders were issued during construction which called for quality of material improvements, thus raising the final general contract cost to \$206,760. Final inspection on December 13, 1971

Education (Extramural)—Group 9A

found all work complete and acceptable. After purchase of 22 16-tray incubators and a minor test fee, the project closed with an unexpended balance of 36,656. (Weaver-Wisconsin)

DESIGN FOR FUTURE PROGRAM CON-STRUCTION, Washington State Dept. of Fisheries, Olympia. Engineering and Construction Div.

R. A. JOHES.

Available from the National Technical Informa-tion Service as COM-72 11070. National Marine Fisheries Service, Completion Report Project AFC-40, February 1972. 7 fig.

Descriptors: \*Fish handling facilities, \*Estimated costs, \*Project planning, \*Design, Fish hatcheries, \*Washington

Identifiers: Hood Canal (Wash).

Plans, specifications, and cost estimates for ten in-dividual projects for a fish handling facility involv-ing water supply, holding ponds, pumping and trap, and fishway improvements in Washington State are listed. All designs were prepared with design criteria established by the Hatchery Divi-sion of the Washington Dept. of Fisheries. Changes in program priorities for investment which occurred and affected achievement of initial project goals are enumerated. These included changes in over-all investment priorities neces-sitating supension of work on yet uncompleted stating suspension of work on yet uncompleted projects and changes in project scale. Completed general plans and project layouts are included. (Weaver-Wisconsin)

EFFECT OF FISH REMOVAL ON THE GROWTH AND CONDITION OF WHITE SHRIMP, PENAEUS SETIFEROUS (LINNAEUS), IN BRACKISH PONDS,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 02L. W73-14587

DEPURATION OF BILOXI BAY OYSTERS BY RELAYING.

Gulf Coast Research Lab., Ocean Springs, Miss. For primary bibliographic entry see Field 05C. W73-14593

CASCADE RIVER STREAM IMPROVEMENT. Washington State Dept. of Fisheries, Olymphia. R. W. Kramer.

R. W. Kramer. Available from NTIS, Springfield, Va 22151 as COM-72-11101 Price \$3.00, printed copy; \$1.45 microfiche. Project Completion Report to NOAA, National Marine Fisheries Service, October 1969.

Descriptors: "Fish passages, "Salmon, "Stream improvement, "Fish management, "Washington, Channel improvement, River training, Engineering, Boulders, Explosives, Fish migration, Anadromous fish, Chinook salmon, "Washington, Identifiers: "Cascade River (Wash), Skagit County

Boulders and ledges in the bed of the Cascade River, Skagit County, Washington, were altered to widen the stream channel and reduce the gradient to enhance passage of chinook and coho salmon. Drilling and blasting of one large granite boulder, ledges and other rock leveled the area to existing water surface or lower, thereby widening the stream channel and reducing the abrupt gradient to provide easier fish passage. Observations have been made periodically of the work area to deter-mine passage conditions at various streamflows. Some of the blasted rock remains in the stream channel but it does not hinder migration. (Woodard-USGS) W73-14594

ESTIMATION OF ROTENONE CONCENTRA-TION BY BIOASSAY, New York State Dept. of Environmental Conservation, Delmar. Wildlife Research Lab.

H. A. Loeb, and R. Engstrom-Heg. N Y Fish Game J, Vol 18, No 2, p 129-134, 1971,

Identifiers: \*Bioassay, Fishery management, \*Rotenone, Salmo-trutta. \*Brown trout.

Concentration-response curves were determined for brown trout (Salmo trutta) placed in water dispersions of emulsifiable rotenone. The response measured was loss of equilibrium. The values obtained yielded linear plots on logarithmic paper, when estimated threshold values were subtracted from the concentrations and response times. Linear plots were also obtained by plotting reciprocals of response times against logarithms of concentrations, using semi-logarithmic paper. The intercept of the regression line with the log concentration axis is an estimate of the threshold concentration. The curves obtained have proved to be reliable indicators of residual rotenone concentra-tions, particularly within the 0.05 to 0.3 ppm con-centration range.—Copyright 1973, Biological Abstracts, Inc.

RECOLONIZATION OF A ROTENONE-TREATED SEGMENT OF THE TEN MILE

New York State Dept. of Environmental Conservation, Delmar. Wildlife Research Lab. R. Engstrom-Heg, and H. A. Loeb. N Y Fish Game J, Vol 18, No 2, p 135-138, 1971. Identifiers: American eel, Biomass (Fish), Eel, Fish populations, Rivers, \*Rotenone, \*New York (Ten Mile River), \*Recolonization (Fish).

Recolonization of the upstream 500 ft of a 2100-ft rotenone-treated section of the Ten Mile River was studied over a 10-mo. period. At the end of the period, the fish population and fish biomass were estimated as 69.2 and 32.1% of their respective pretreatment values. Immigrant fish of most species tended to be smaller and younger than fish of the same species in the pretreatment population. A notable exception was the American eel, the species contributing most to the fish biomass.--Copy-right 1973, Biological Abstracts, Inc. W73-14742

EFFECTS OF CONTROLLED FLOW REDUC-Alberta Dept. of Lands and Forests, Red Deer. Fish and Wildlife Div. M. E. Kraft. TION ON A TROUT STREAM

J Fish Res Board Can, Vol 29, No 10, p 1405-1411, 1972 Illus

Identifiers: Controlled flow, Movements (Fish), Streams, Tag, \*Trout, \*Montana (Blacktail Streams, Creek).

The total number of brook trout age I and older in 3 runs of Blacktail Creek, Montana, was reduced approximately 62% when 90% of the normal flow was diverted for about 3 mo., in comparison with 20% for runs in control sections. Both number and weight of trout in pools of the test sections generally increased, whereas those in control pools decreased. Recaptures of tagged trout also indicated movements from runs to pools in the test sections, but not in the control sections. When the flow was reduced 75% or less, there were no consistent changes in number or weight of trout in the test runs and pools, whereas those in the control sections were more marked though also inconsistent. Reduced flows had no consistent effect on the number of underyearlings. The changes in most physical characteristics after 90% flow reduction were considerably less than the degree of reduction, presumably because the stream flowed in a well defined channel. Surface area and average depth were least affected (about 42% decrease) and current velocity (75%) the most. Fast-water portions (current velocity over 0.30 m/sec) comprised over 60% of the surface area at normal flows and slow water portions over 85% of the area when the flow was reduced 90%. A multiple linear regression with the physical characteristics as independent variables and the number of trout as the dependent variable accounted for over 75% of the variation in the number of age I and older trout in runs and pools .-- Copyright 1973, Biological Abstracts, Inc.

## 09. MANPOWER, GRANTS AND FACILITIES

#### 9A. Education (Extramural)

NEBRASKA WATER RESOURCES RESEARCH INSTITUTE - PAST, PRESENT AND FUTURE. Nebraska Univ., Lincoln. Water Resource Research Inst.

Available from the National Technical Information Service as PB-223 374, \$2.75 in paper copy, \$1.45 in microfiche. Publication No 9, March 1973. 16 p. OWRR A-999-NEB (12). 14-31-0001-3827.

Descriptors: \*Education, \*Training, resources, Insitute, Universities, Colleges, \*Research and development. Identifiers: Technology transfer.

A brief report is presented of the Nebraska Institute's activities and prospects for the future. Research, technology transfer and education and training are described. W73-14209

INVENTORY OF WATER RESOURCES CON-DUCTED IN MINNESOTA 1963 THROUGH

Minnesota Univ., St. Paul. Water Resources Research Center. For primary bibliographic entry see Field 09D. W73-14366

WATER RESOURCES CENTER ANNUAL RE-PORT, 1 JULY 1971 - 30 JUNE 1972. California Univ., Davis. Water Resources Center.

Available from the National Technical Information Service as PB-223 564, \$9.00 in paper copy, \$1.45 in microfiche. Report No. 25, January, 1973. 133 p. OWRR A-999-CAL (7).

Descriptors: \*California, \*Water resources institute, Training, Education, \*Research, Projects. Universities.

The annual activity is summarized of the sponsored research program of the Water Resources Center of the University of California. Summary reports of individual research projects are presented together with statement of publications available from each project. Projects covered include those financed by the State of California and by the Office of Water Resources Research of the U. S. Department of Interior under Title I of PL 88-379. Also included is a summary of the information dissemination program of the California Water Resources Center and other activities relevent to development of the overall program. W73-14370

# Field 09-MANPOWER, GRANTS AND FACILITIES

# Group 9D—Grants, Contracts, and Research Act Allotments

## 9D. Grants, Contracts, and Research Act Allotments

INVENTORY OF WATER RESOURCES CON-DUCTED IN MINNESOTA 1963 THROUGH

1972, Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service as PB-223 432, \$7.25 in paper copy, \$1.45 in microfiche. Bulletin 65. August 1973. 95 p, 7 tab. OWRR A-028-MINN (2).

Descriptors: \*Water resources, \*Research, \*Minnesota, Manpower, \*Universities, Training, Education, \*Federal government, \*Projects, Industries, Utilities.

Total annual water resource research effort in Minnesota in terms of number of ongoing projects increased from 65 in 1963 to 149 in 1971 and was 140 in 1972. The estimated annual man-years of effort rose from 41.1 in 1963 to 200.1 in 1972. Total annual expenditures increased from \$620,000 in 1963 to \$3,900,000 in 1972. In 1972, Federal agencies conducted the greatest amount (50 percent of total) of water resources research in Minnesota with the University of Minnesota, Consultant, Private Organizations, State and Private Colleges and State agencies following in that order. The percentages of the total research conducted by individual Federal agencies were as follows: Environmental Protection Agency (National Water Quality Laboratory) - 42, U. S. Department of Agriculture (Agricultural Research Service) - 4, U. S. Department of Agriculture (Forest Service) - 2, and U. S. Department of the Interior (Geological Survey) - 2. Organizations funding the greatest amounts of water resources research in 1972 were: Environmental Protection Agency, U. S. Department of the Interior, U. S. Department of Agriculture, U. S. Department of Navy, National Science Foundation, Atomic Energy Commission, Northern States Power Company, Department of Defense and State agencies. W73-14366

WATER RESOURCES CENTER ANNUAL RE-PORT, 1 JULY 1971 - 30 JUNE 1972. California Univ., Davis. Water Resources Center. For primary bibliographic entry see Field 09A. W73-14370

THE NATURE OF CHEMISTRY IN THE NA-TIONAL SEA GRANT PROGRAM, National Oceanic and Atmospheric Administration, Rockville, Md. For primary bibliographic entry see Field 02K.

## 10. SCIENTIFIC AND TECHNICAL INFORMATION

#### 10A. Acquisition And Processing

RESEARCH FOR APPLICATION OF REMOTE SENSING TO STATE AND LOCAL GOVERN-MENTS (ARSIG), Arizona Univ., Tucson. Office of Arid Lands Stu-

For primary bibliographic entry see Field 07C. W73-14349

## 10F. Preparation of Reviews

A SELECTED ANNOTATED BIBLIOGRAPHY ON WATER RESOURCES OF THE STATE OF WASHINGTON. Washington State Dept. of Ecology, Olympia. For primary bibliographic entry see Field 02E.

W73-14201

A SELECTED ANNOTATED BIBLIOGRAPHY ON COLUMBIA AND SNAKE RIVERS. Washington State Dept. of Ecology, Olympia. For primary bibliographic entry see Field 02E. For primary W73-14202

EFFECTS OF POLLUTION ON FRESHWATER

National Water Quality Lab., Duluth, Minn For primary bibliographic entry see Field 05C. W73-14259

MICROBIOLOGY OF WATER, Environmental Protection Agency, Cincinnati, Ohio. Water Supply Research Lab. For primary bibliographic entry see Field 05B. W73-14260

MICROBIOLOGY OF WASTE TREATMENT, Pennsylvania State Univ., University Park. For primary bibliographic entry see Field 05D. W73-14261

MICROBIOLOGY - WATERBORNE OUT-National Environmental Research Center, Cincinnati, Ohio. For primary bibliographic entry see Field 05C. W73-14262

MICROBIOLOGY-DETECTION OF BACTERI-AL PATHOGENS AND THEIR OCCURRENCE, National Environmental Research Center, Cincin-For primary bibliographic entry see Field 05A. W73-14263

MICROBIOLOGY-DETECTION AND OCCUR-RENCE OF VIRUSES, National Environmental Research Center, Cincinnati. Ohio. For primary bibliographic entry see Field 05A. W73-14264

AQUATIC SEDIMENTS, Massachusetts Univ., Amherst. For primary bibliographic entry see Field 05C. W73-14265

MARINE AND ESTUARINE POLLUTION, California State Univ., Long Beach. Dept. of Biology. For prim mary bibliographic entry see Field 05B. W73-14266

HEAVY METALS: A REVIEW OF LEAD, Illinois Univ., Urbana For primary bibliographic entry see Field 05B. W73-14267

THERMAL EFFECTS. Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W73-14268

EUTROPHICATION, New York State Dept. of Environmental Conser-vation, Stony Brook. For primary bibliographic entry see Field 05C. W73-14269 ACA

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	Cornell University, Policy Models for Water Resources Systems	W73-14457 - 14466 14666 - 14674	19
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	National Water Well Association, Water Well Construction Technology	W73-14703 14706 14708 14733	30
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	Office of Saline Water	W73-14377 14388	12
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# CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

#### Supported by the Environmental Protection Agency in cooperation with WRSIC

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.

#### **Subject Fields**

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